JUN 26 1991 (20) START

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(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-AP-052		0	Site-wide Background Soil Sampling Plan	3	1	1	

OCT 1991 RECEIVED EDMC

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 see MRP 5.43 and EP-1.7	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp
1	1	Cog./Proj. Eng C.D. Kramer	C.D. Kramer	6/26/91	H4-55						
1	1	Cog./Proj. Eng. Mgr. R.P. Henckel	RPH	6/26/91	H4-55	H4-55					
1	1	QA D.G. Farwick	DG Farwick	6/26/91	H4-16	H4-16					
		Safety									
1	1	A.L. Prignano	A. Prignano	6/26/91	H4-57						
1	1	F.A. Ruck	Deal [illegible] for FAR	6/28/91	H4-57						

18.	19.	20.	21. DOE APPROVAL (if required)
C. D. Kramer 6/26/91 Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	RPH 6/26/91 Cognizant/Project Engineer's Manager Date	Ltr No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

BD-7400-172 (2/89)

INSTRUCTIONS FOR COMPLETION OF THE ENGINEERING DATA TRANSMITTAL

(USE BLACK INK OR TYPE)

BLOCK	TITLE	
(1)*	EDT	• Enter the assigned EDT number.
(2)	To: (Receiving Organization)	• Enter the individual's name, title of the organization, or entity (e.g., Distribution) that the EDT is being transmitted to.
(3)	From: (Originating Organization)	• Enter the title of the organization originating and transmitting the EDT.
(4)	Related EDT	• Enter EDT numbers which relate to the data being transmitted.
(5)*	Project/Program/Dept//Div	• Enter the Project/Program/Department/Division title or Project/Program acronym or Project Number. Work Order Number or Organization Code.
(6)	Cognizant /Project Engineer	• Enter the name of the individual identified as being responsible for coordinating disposition of the EDT.
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(17)	Signature/Distribution	
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	(L) Date	• Enter date signature is obtained.
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(18)	Signature of EDT Originator	• Enter the signature and date of the individual originating the EDT (entered prior to transmittal to Receiving Organization). If the EDT originator is the Cognizant/Project Engineer, sign both Blocks 17 and 18.
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BD-7400-172R (2/89)

SUPPORTING DOCUMENT

1 Total Pages ~~60~~ 59

2. Title	3. Number	4. Rev. No.
Site-Wide Background Soil Sampling Plan	WHC-SD- EN-AP-052	0

5. Key Words

Background, Composition, Soil, Natural, Hazardous Substance, Waste, Sampling Plan

6. Author

C. D. Kramer
Name (Type or Print)

C. D. Kramer
Signature

81223 /EK16B
Organization/Charge Code 6C276

7. Abstract

This document describes a proposed sampling effort of background sites representative of Hanford Site soils and subsoils. A variety of sites are to be selected primarily based upon accessibility, professional judgement, variety of material, and lack of significant known or suspect local contamination. This effort has developed from the approach described in *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246. It is meant to provide baseline information for use in Hanford Site cleanup activities.

APPROVED FOR PUBLIC RELEASE
V. Birkland 6/26/91

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CONTENTS

APPENDICES

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SITE-WIDE BACKGROUND SOIL SAMPLING PLAN

1.0 OBJECTIVE

This plan outlines the sample collection and analysis effort for a Hanford site-wide soil background study. Baseline data will be generated to support Hanford cleanup activities. The word "soil" is meant to be understood as that called "soil" in the context of environmental cleanup regulations--not another field of study. The collection and analysis effort will employ procedures used for characterization activities. Both the concentration and variability of selected naturally occurring soil constituents are of interest.

The domain of the study will be a variety of judgement-selected locations within the boundaries of the U.S. Department of Energy's Hanford Site. Selected locations will include the Hanford formation and younger geologic units.

Samples will represent a compositional range typical of uncontaminated Hanford Site soil. Study results will provide regional Hanford Site background data, rather than specific localized background data for any particular Hanford hazardous waste site, or waste management unit. Data will support the development of contamination identification and cleanup standards for the Hanford Site by (1) allowing for testing and refinement of a site conceptual model, and (2) providing a database for future comparisons.

This plan is intended to be a general soil sampling plan to support and integrate with the activities evolving from the Environmental Division background task teams. The draft Westinghouse Hanford Company (Westinghouse Hanford) document, *Characterization and Use of Soil and Groundwater Background for the Hanford Site* (WHC 1991), has served as a basis for this plan. The sampling covered by this plan is currently proposed for fiscal year 1991.

2.0 PROJECT/FIELD TEAM ORGANIZATION

Overall project organization is the responsibility of the Westinghouse Hanford Environmental Division RCRA Closure Activities Section as sponsor of the background task teams (see Appendix A and Figure A-1). A project coordinator (Project Lead) has been assigned by management. Various tasks have been delegated among the participants of the background strategy task team. Development and performance of this sampling plan combined with other task team work will help achieve the overall project objectives. The Project Lead will be a focal point for project-related decisions, and will facilitate work on all aspects of this project.

The Westinghouse Hanford Geosciences Group will be responsible for choosing general sampling locations in conjunction with the Project Lead or designee, and for determining specific authoritative sample locations, geologic logging, and geological interpretation. The field team geologist shall be a member of the Geosciences Group.

Field team leadership shall be provided by the Westinghouse Hanford Environmental Engineering Group. The Environmental Engineering Group will interface with Environmental Field Services, Office of Sample Management (OSM), Traffic and Shipping, Operations Support Services, and other organizations as necessary to perform sampling as directed by the Project Lead. The OSM shall be responsible for arranging laboratory support and validating related chemical analyses. All field activities are to be consistent with this sampling plan and applicable sections of WHC-CM-7-7 (WHC 1988a).

Members of the field team shall include the team leader, geologist(s), samplers, and the following, as necessary: health and safety personnel, quality assurance and/or operations support personnel. All field personnel shall be familiar with this plan, the Quality Assurance Project Plan (Appendix A), and the appropriate job safety analysis (JSA) (or Health and Safety Plan, if applicable) before sample collection. It is the responsibility of the Field Team Leader to have a copy of this plan and the JSA (or Health and Safety Plan, if applicable) for field reference.

Because this project involves multiple separate areas to be sampled, the Project Lead will assign an individual(s) to determine and confirm that current requirements, if any, are met with respect to an excavation permit, cultural resource review, and *National Environmental Policy Act of 1969* documentation. Sampling will not be undertaken at any location for which applicable requirements of the aforementioned are not satisfied. If the assigned individual(s) is not the Field Team Leader, documentation will be furnished to the Field Team Leader to confirm compliance.

3.0 SCHEDULE

Sampling will begin upon approval of this plan. Sampling is scheduled to be completed by August 1991, subject to laboratory availability. Laboratory availability for all mandatory analytes will be confirmed before samples are collected. Sampling after August 1991 shall be authorized by the Westinghouse Environmental Division RCRA Closure Activities Section manager. Samples collected after August 1991 may require fast laboratory turnaround to complete current project reporting schedules. The OSM shall provide a complete and validated data package by October 1 for all samples received by the laboratory before August 1991. Project reporting is currently scheduled for completion by the end of January 1992. Deviations to this schedule may be arranged by the Plan Lead or delegate. Schedule changes will be documented in project files by an Internal Memo. Schedule changes alone will not be sufficient cause to issue plan revisions.

4.0 SAMPLING EQUIPMENT

Samples will be collected using stainless steel tools. Collection equipment may include trowels, spoons, scoopulas, bowls, screens, and funnels. All tools contacting the sample material will be laboratory decontaminated in accordance with EII 5.5, "1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment" (WHC 1988a), or other approved method. Sampling site overburden may be removed with non-stainless steel tools. The Field Team Leader will be responsible for providing or arranging for enough decontaminated equipment and sample jars to complete each day's sampling activities.

Sample jars will either be cleaned by Westinghouse Hanford personnel, per EII 5.5 (WHC 1988a) or equivalent, or will be purchased precleaned from a sample jar supplier. In the latter case, evidence of cleanliness may include a quality control certificate of analysis from a reputable supplier, and tamper-indicating seals on unopened factory cartons. Archived samples shall be kept in jars cleaned to similar standards as those containing samples for chemical analyses. All sample jars shall be kept closed while in storage.

As a matter of policy, Westinghouse Hanford requires a radiological survey of all sample material prior to transport off the Site (see Section 9.0). This total activity determination is for release from administrative radiologic controls. Containers for material to be surveyed may be new, stores-stocked containers. The latter may be rinsed with deionized water prior to use (at the Field Team Leader's option), but need not necessarily be chemically decontaminated by EII 5.5 (WHC 1988a).

Other common supplies used by the sampling team may include, but are not limited to, the following.

Shovels Latex or vinyl gloves Ice chests with wet or "blue" ice Absorbent (vermiculite) for shipping Permanent black marking pens Evidence tape Measuring tapes Compass Maps Plastic bags (variety of sizes) Squirt bottles Water (potable and deionized) Cups Sample Labels Tape (masking, plastic, and duct) Scissors Forms • Chain-of-custody • Sample Analysis Request • Offsite Property Control • Geotechnical Sample Transfer Record	Paper towels Clean rags Plastic or paper sheeting Field work table Black pens Wooden stakes Bright flagging material Hammer Ropes Ladders Camera with film Coveralls (Blues) Personal safety equipment Dilute HCl Hand lens Logbook

5.0 SELECTION OF GENERAL SAMPLE SITES

General background sampling areas were determined by soil exposure and accessibility, professional judgement, and opportunity. The stratigraphic units of the study population are (1) the early to late Pleistocene Hanford formation, (2) late Pleistocene-Holocene Columbia River and side stream deposits, and (3) Pleistocene to Holocene eolian deposits. Sites at which a variety of soil types could be sampled were favored over those exhibiting only a single type.

Fourteen general sites have been identified within the project area as suitable candidates for sampling. Twelve of these sites are within the boundaries of the Hanford Site. Two sites are located outside Hanford boundaries, east of the Columbia River. Most samples will be taken from the vertical exposures of borrow pits or outcrops. Appendix B contains maps showing aggregate and individual site locations. Additional sites may be included at the discretion of the Project Lead with management approval. The Project Lead will document the inclusion of any additional sites by a letter of instruction to the Environmental Engineering Technical Baseline manager and the assigned Field Team Leader. A copy of this letter will be retained in the associated project file records by the Project Lead.

A prime requirement of all sample locations was and is no known or suspected significant, localized soil contamination. The Field Team Leader is authorized to disqualify any sample collection locations that, in his or her judgement, do not reflect sufficiently native conditions in part of the Hanford Site vadose zone.

6.0 SELECTION OF SAMPLE MATERIAL

6.1 DEFINITIONS

- *Sample*: A sample shall consist of an adequate volume of soil mixed in the field and submitted for the analysis and/or archiving. Samples will be processed to achieve a degree of homogeneity throughout the media thereby minimizing subsample variability.

- *Field Split Samples*: Two or more sample volumes collected in such a manner that they are equally representative of the variables of interest at a given location. For this study, split samples shall be mixed either in a large stainless steel container or in-place at the site of collection.

- *Collocated Samples*: Uncomingled samples attributed to a common location in the time and space. Whereas field split samples have been mixed and reallocated by sample collection, collocated samples have preserved natural diversity between samples ascribed to the location.

- *Subsample*: A portion of a sample less than the entire sample. Subsamples will be submitted for analysis. For example, from one sample point, two 120-mL portions may be submitted for various analyses, and another 120-mL jar archived. They may be generically referred to as samples.

- *Representative*: Exhibiting a typical or common characteristic of a class. A sample is representative of an entire population only to the extent that it reflects the average of that population.

- *End member*: One of the two extremes of a geologic compositional series.

Additional definitions can be found in the glossary of Appendix A.

6.2 CHOOSING THE SAMPLE

The following four basic categories of samples will be selected from the field:

- Systematic samples
- Judgement (authoritative) samples
- Grain size effect samples
- Organic analyses samples.

Each sample shall be composed of material collected from a single contiguous area (i.e., not a composite). Aliquots from the sampled locations may be reserved for radiologic shipping surveys (Section 9.0). Aliquots collected for this purpose can be composited at the Field Team Leader's discretion.

Consistent with the requirements of EII 5.1 (WHC 1988a), a representative portion of each sample is to be sent to the analytical laboratory. The remainder of the sample is to be archived in the Hanford Geotechnical Library should further analyses be desired. Unused samples may be disposed of after 24 months with written permission from the Project Lead.

6.2.1 Systematic Samples

These samples will be selected by systematic allocation along a single line perpendicular to the major strata at a site; the number of samples at each site will be proportional to the vertical height of the exposure to be sampled. The Project Lead will assign an individual to provide the Field Team Leader with a suggested target number and spacing of systematic population samples to be chosen at each general location. The distance between sample points shall remain relatively constant throughout all locations. The geologist will determine, consistent with the above constraints, which general section of the exposure is most representative for sampling. The Field Team Leader will randomly select an initial sample location from the eligible surface. Sample points will be centered at regular intervals from this point to the upper- and lowermost eligible areas. Field splits (3) shall be collected at the randomly determined initial sample location. Two will be submitted for inorganic chemical analysis. See Section 6.2.3 for a discussion of the third split sample.

6.2.2 Judgement Samples

Specific locations of judgement samples will be based solely upon professional judgement of the geologist field team member. The objective of this sampling is to allow the geologist to have the latitude to collect the following:

- Selected end member samples
- Potential outlier samples
- Samples that represent typical local lithology.

As a matter of allocation of project resources, it is recommended that the total judgement samples collected throughout the project not exceed the total systematic samples.

Compositional end members are discussed further in *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246 (WHC 1991). End members are defined to be either quartz-feldspar or basaltic silts and sands. Potential outlier samples are those materials that are compositionally discontinuous with the above series. They are not mixtures of quartz-feldspar and basaltic silts and sands. Such samples may be ash layers, caliche, etc. The geologist also may select samples representative of the major lithologies at the sites.

6.2.3 Grain Size Effect Samples

An evaluation of the effect of grain size on leachate concentrations for inorganic species will be conducted in conjunction with soil sampling and analysis for the Site-wide background survey (see Appendix A1.2). Material for grain size effect samples shall be collected from the same location where field split samples are collected. These samples will be collected as one of three field splits from the selected locations. Sample jars of the same dimensions as those submitted for chemical analysis will be used with this exception: a third 250-mL archived portion need not be retained from the location of the field split samples. After collection, a random-number table or equivalent will be used to assign subsamples for grain size analysis, and chemical analyses of routine samples and splits.

6.2.4 Samples for Organic Analysis

A limited number of samples for organic analysis will be collected. These samples are independent of samples associated with the three previous basic categories. Samples will be analyzed for total organic carbon (TOC), routine Contract Laboratory Program (CLP) volatiles, semivolatiles, organochlorine pesticides, and polychlorinated biphenyls (PCB). Tentatively identified compounds also may be reported in accordance with CLP protocols. Two samples are to be collected from each general site. One is to be selected no deeper than the upper foot of surface soil; the other is to be selected from the point of an exposure roughly corresponding to a 3-ft depth. As with systematic sample selection (Section 6.2.1), the geologist will select eligible surface and exposed areas, and the Field Team Leader will randomly select a specific location within that area. It is recommended that these samples be collected in an effort separate from other sampling. This decision will be made by the Field Team Leader at the time of sampling. This will help to reduce the relative proportion of field and laboratory quality control samples required to support the work.

6.3 WHAT MATERIAL IS EXCLUDED

Sample collection may exclude stones, organic debris, etc., that are larger than 2 mm. The *Model Toxics Control Act Cleanup Regulations* (Ecology 1991) specify soil compliance monitoring on the <2-mm-size fraction unless larger particles can be expected to contain higher concentrations of hazardous substances. Because most situations at the Hanford Site involve soil contaminated by various liquid sources, the 2-mm-size fraction cutoff point will be applicable. In lieu of onsite sieving to 2-mm, the analytical chemistry facilities must be instructed when to use only the <2-mm portion of submitted material.

Where field and/or laboratory sieving would be reasonably expected to compromise the analysis, it shall not be performed. This would be the case for volatile organic analyses. Loss and/or absorption of volatiles during sieving would result in an unrepresentative sample of that size fraction. Aliquots submitted for all other chemical analyses shall be sieved.

Recent river, stream, lake, or pond sediments are not within the scope of this study. (This is not intended to be confused with a geologic definition of a sediment.) For the purposes of this study, any soil covered by an open body of water at the time of sample collection shall be considered a sediment.

7.0 BOTTLE AND FIELD PACKAGING REQUIREMENTS

Samples are to be collected in compliance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988a). Sample numbers are to be obtained from OSM. Unused sample numbers will be returned to OSM after sampling concludes.

Sample labels should include at least the following:

- Company name (or initials, WHC)
- Company contact and phone number
- Hanford Environmental Information System (HEIS) sample number

- Name of collector
- Date and time of collection
- General place of collection.

Tamper-indicating seals must be attached in such a way as to require breaking to open the sample container. The seals must be applied before samples leave the custody of sampling personnel. Sampling personnel must date and initial the seals.

Samples submitted for total activity may be composite samples. The Field Team Leader may exercise discretion when determining how many samples to represent with each composite. There shall be at least one total activity sample for each ice chest of samples to be sent offsite.

Sample analytes, volumes, and type of jar are as follows:

- Inorganics--Three 120-mL glass or plastic jars.
- Archived Subsample--One 250-mL (or two 120-mL) glass or plastic jars for all samples submitted for inorganics, and one 120-mL jar for grain size samples (see below).
- Grain Size--Two 120-mL glass or plastic jars for analysis and one 120-mL jar reserved as archived material.
- Total Activity--One glass or plastic jar with ≥10 g of soil.
- Volatiles--Two 120-mL glass jars.
- Semivolatiles, Pesticides/PCBs--One 250-mL or two 120-mL glass jars.
- TOC--One 120-mL glass jar.

Glass jars are required to have teflon-lined caps. All sample containers shall meet the requirements of Section 4.0. Additional 120-mL containers may be submitted for chemical analyses, if necessary.

8.0 CHEMICAL ANALYSES

Analytical methodology to be used is listed in Appendix A. Section 9.0 of this plan deals with radiation surveys. Additional analyses may be performed on any archived portion with written permission from the Plan Lead. The analysis methodology, provision for quality control, and return of any material shall be specified in the request.

Onsite analytical work shall be arranged by the Project Lead or designee. Offsite analytical work for the inorganic and organic analyses that follow shall be requested by an Environmental Engineering task order to OSM.

The task order title will be "Site-Wide Soil Background." Task agreements developed by OSM will be consistent with Appendix A.

INORGANICS

All systematic and judgement-selected samples are to be analyzed for the following list of inorganic analytes.

Inductively Coupled Plasma Method Metals

Aluminum	Iron	Silicon
Barium	Magnesium	Silver
Beryllium	Manganese	Sodium
Calcium	Molybdenum	Titanium
Chromium	Nickel	Vanadium
Cobalt	Potassium	Zinc
Copper		Zirconium

Atomic Absorption Method Metals

Antimony	Cadmium	Selenium
Arsenic	Lead	Thallium
	Mercury	

Anions and other analytes

Chloride	Nitrite	Carbonate
Nitrate	Phosphate	Ammonium
Fluoride	Sulfate	

GRAIN SIZE

Westinghouse Hanford personnel will perform separate sieve analyses on each submitted subsample in accordance with Section 11.2 and Appendix A.

ORGANICS

Samples collected for organic analysis will be analyzed for the most recent CLP Statement of Work volatile organic, semivolatile, and pesticide/PCB target compound list. Subsamples shall also be analyzed for TOC.

9.0 RADIOLOGICAL SURVEYS

Movement of samples originating on the Hanford Site will be subject to radiologic controls. Offsite shipment will require a total activity analysis at the 222-S Laboratory or a comparable facility for this determination. Samples received by the Geotechnical Library for archiving will require a radiological survey. The Health Physics organization shall be responsible for designating the radiologic status of the samples. Any sample or subsample that does not qualify for unconditional offsite release will be excluded from the study. The Project Lead is to be notified promptly by the Field Team Leader if this occurs.

10.0 SHIPPING

Shipping will be performed in compliance with EII 5.11 (WHC 1988a). The Field Team Leader may designate a member of the field team to be responsible for outgoing shipments. This person(s) should coordinate shipping with Westinghouse Hanford Shipping personnel at least 1 week before sample collection. Generally, samples should be at Shipping by 1300 hours.

Samples leaving the city of Richland will be shipped in ice chests with "blue" ice. Vermiculite or similar absorbent should be placed over and around samples for padding and insulation. Ice chests should not be sealed until final shipping documentation is placed inside. This will include the chain-of-custody form, sample analysis requests, and an offsite property control form (OPSC). (Retain photocopies of at least the chain-of-custody and analysis request forms.) Copies shall be forwarded to OSM.

A bill of lading number is obtained from Westinghouse Hanford Shipping and placed on the OSPC form. A unique OSPC "serial" number and approval need to be obtained from Westinghouse Hanford Property Management (1163 Building, room 396L). Record the bill of lading and OSPC serial numbers on the chain-of-custody form.

11.0 QUALITY CONTROL

11.1 FIELD DOCUMENTATION

Documents to be originated and maintained by field personnel include a controlled field logbook, chain-of-custody documentation, and sample analysis requests.

A field logbook will be kept by the Field Team Leader or his designee consistent with the instructions for RCRA and CERCLA/SARA field activities, EII 1.5, "Field Logbooks." Sufficiently detailed information should be entered to allow unfamiliar personnel to reconstruct sampling activities. The minimal information necessary to support project objectives will include the following:

- Names of individuals involved in field activity
- Signature of person making the entry
- Locations of all sampling points

- Site description
- Sample identification
- Date and time of collection
- Method of choosing exact location
- Method of collection
- Type and origin of sample containers
- Problems and corrective action, if necessary.

Conditions and the exact location of each sampling site should be documented with photographs (prints or slides) before, during, or immediately after sampling. Attempt to obtain a photographic record of both the specific and general location to the extent feasible. An object to show scale also may be helpful. A detailed description of each photograph should be maintained for future reference. At a minimum, this should include a record of the time, date, and location of the photograph.

The geologist is required to maintain a controlled logbook. At a minimum, the geologist will record a geologic description of the sampled area and material collected. This will include the thickness of the sampled unit and approximate depth from the surface. Many sample locations in this study will be specified by the geologist in the field. The justification for field decisions regarding sampled location will be outlined in this logbook.

The Field Team Leader will maintain a file of project-related documentation and will be responsible for final disposition of its contents in accordance with EII 1.6, "Records Management." Individuals will be responsible for the final disposition of assigned logbooks. The Project Lead will be responsible for other project data in accordance with Chapter 1.0 of WHC-CM-7-7 (WHC 1988a).

11.2 QUALITY CONTROL SAMPLING

Unused portions of all samples will be stored at the Geotechnical Library in accordance with Section 5.2.2.

For split samples, it is recommended that sample containers be filled concurrently rather than sequentially to further minimize the affect of any stratification of analytes in the media. The purpose is to minimize variability, and provide substantially identical samples.

Field quality control sampling will be as follows for systematic and judgement sampling:

- One set of split samples per general site for systematic sampling
- One set of split samples per general site for judgement sampling.

An aliquot of one sample will be sent to the primary laboratory; the other sample sent to an alternate laboratory. In the event that an alternate laboratory is not available for a particular analysis, the Project Lead may direct the Field Team Leader to temporally separate the submission of split samples to a single laboratory. This will be bounded by the ability of laboratory to analyze the sample within the respective allowed holding time. These samples will be used to estimate precision of the entire measurement system.

Field quality control for volatile organic sampling shall include the following:

- <u>One pair of collocated samples for each 10 samples</u>--Collect it at the first or second sample point and every tenth point thereafter. One of the pair should be sent to the primary laboratory, and the other should be sent to an alternate laboratory. Samples will be considered as collocated when removed concurrently from a common sampling point. Collect at least one collocated pair per sampling day.

- <u>One sand equipment/field blank for each 10 samples</u>--Expose trip blank material to ambient field conditions and collection equipment. The blanks may be increased to one per general site at the Field Team Leader's discretion. Collect at least one volatile organic analysis (VOA) field blank per sampling day.

- <u>One sand trip blank for each 20 samples</u>--Use collection equipment similar to that used in the field to process this sample. Do not open this container in the field unless preparing a field blank. Submit at least one per ice chest of VOA samples (see Appendix A, Section A9.0).

At the Project Lead's option, material submitted for VOA blanks may be heat treated or microwaved before use to reduce the possibility of the presence of any detectable volatile compounds. If such operations are performed, they will be documented in project records. Attempt to separate in both time and location those blanks collected in a single day.

Field quality control for semivolatile, pesticide/PCB, and TOC sampling shall include the following:

- <u>One pair of collocated samples for each 20 samples</u>--Collect it at the first or second sample point and every 20th point thereafter. One of the pair should be sent to the primary laboratory, and the other should be sent to an alternate laboratory. Samples will be considered as collocated when removed concurrently from a common sampling point. Collect at least one collocated pair per sampling day for each analysis.

- <u>One sand equipment/field blank for each 20 samples</u>--Expose sand blank material to ambient field conditions and collection equipment. The blanks may be increased to one per general site at the Field Team Leader's discretion. Collect at least one field blank per sampling day for semivolatiles and pesticides/PCBs. Field blanks are not required for TOC measurements.

Grain size sampling shall include the following:

- Duplicate subsamples for each sample--Two identical containers for separate analysis. Remaining sample material should be reserved for optional, Project Lead-specified analyses and/or submitted to the Geotechnical Library.

11.3 SAMPLING PLAN DEVIATIONS

Every reasonable effort will be made to comply with the intent of this sampling plan as written. Significant revisions to this plan may be made in accordance with WHC-CM-6-1, *Standard Engineering Practices* (WHC 1988b). Deviations from the EII because of unforeseen situations may be made by following EII 1.4. Should field conditions require minor modification of this plan, the problem and its solution will be documented in the appropriate logbook as soon as possible. Minor modifications are those not affecting the schedule or cost of this project by more than 10%. The Field Team Leader may exercise his or her discretion or consult with management regarding field problems. Field deviations shall not compromise data quality. Field deviations are justified when they improve the efficiency of achieving project objectives without jeopardizing safety or environmental protection.

12.0 JOB SAFETY REQUIREMENTS

A health and safety evaluation and project safety review (as necessary) shall be performed before sample collection. All field personnel shall read the appropriate JSA (or Health and Safety Plan, if applicable) before sampling. Personnel are subject to the requirements of the applicable document. Pre-job planning and safety meetings will be held at least daily at the work sites. The Field Team Leader shall ensure that adequate communication equipment is available during field activities.

13.0 WASTE MANAGEMENT

No hazardous waste will be generated by field operations. Routine nonhazardous waste disposal methods will be used for waste.

14.0 REFERENCES

Ecology, 1991, *The Model Toxics Control Act Regulation*, Chapter 173-340 WAC, Washington State Department of Ecology, Olympia, Washington.

National Environmental Policy Act of 1969, Public Law 91-190, 83 Stat. 852, 42 USC 4321 et seq.

WHC, 1988a, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC 1988b, *Standard Engineering Practices*, WHC-CM-6-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN FOR HANFORD SITE-WIDE BACKGROUND SOIL SAMPLING

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GLOSSARY

Accuracy: Accuracy is the closeness of a measured value to the true value. It is estimated using reference samples and percent recoveries.

Blind Sample: A blind sample refers to any type of sample routed to the primary laboratory for purposes of auditing performance relative to a particular sample matrix and analytical method. Blind samples are not specifically identified as such to the laboratory; they may be made from traceable standards, or may consist of sample material spiked with a known concentration of a known compound.

Case: The entire number of samples from this study that are submitted for analytical analysis at a particular laboratory.

Contamination: Excess concentration of a material in a detrimental context.

Comparability: Comparability is an expression of the relative confidence with which one data set may be compared with another.

Completeness: Completeness may be interpreted as a qualitative parameter expressing the percentage of measurements judged to be valid.

Hazardous Substance: Defined by section 101(14) of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) as any substance designated pursuant to section 311(b)(2)(A) of the *Clean Water Act*; any element, compound, mixture, solution, or substance designated pursuant to section 102 of CERCLA; any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the *Solid Waste Disposal Act* (but not including any waste the regulation of which under the *Solid Waste Disposal Act* has been suspended by Congress); any toxic pollutant listed under section 112 of the *Clean Air Act*; and any imminently hazardous chemical substance or mixture with respect to which the Administrator has taken action pursuant to section 7 of the *Toxic Substances Control Act*. The term does not include petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance in the first sentence of this paragraph, and the term does not include natural gas, natural gas liquids, liquified natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). [This definition is different from that used in the current state *Dangerous Waste Regulations*, WAC 173-303, but is identical to its use in the *Hanford Federal Facility and Consent Order* (1989).]

Instrument Detection Limit (IDL): As defined per Contract Laboratory Program (CLP) protocol, it will be equivalent to three times the average of standard deviations obtained on three nonconsecutive days from the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times the manufacturer's suggested IDL, with seven consecutive measurements per day.

Method Detection Limit (MDL): As defined per SW-846 Third Edition (EPA 1986a), Chapter ONE, Section 1.3. It is defined as seven times the standard deviation of three replicates of a spiked sample matrix containing the analyte of interest at three to five times the estimated MDL.

Nonconformance: A nonconformance is a deficiency in character, documentation, or procedure that renders the quality of material, equipment, services, or activities unacceptable or indeterminate. When the deficiency is of a minor nature, does not affect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it shall not be categorized as a nonconformance. However, if the nature of the condition is such that it cannot be immediately and satisfactorily corrected, it shall be documented in compliance with approved procedures and brought to the attention of management for disposition and appropriate corrective action.

Precision: A measure of the repeatability or reproductibility of specific measurements under a given set of conditions. Precision may be expressed as standard deviation, coefficient of variation (i.e., relative standard deviation), range, or relative range. Precision is assessed by multiple analyses.

Probability sampling: Sampling that employs a method of random selection.

Quality Assurance: Quality assurance refers to the total integrated quality planning, quality control, quality assessment, and corrective action activities that collectively ensure that the data from monitoring and analysis meets all end user requirements and/or the intended end use of the data.

Quality Control: Quality control refers to the routine application of procedures and defined methods to the performance of sampling, measurement, and analytical processes.

Reference Samples: Reference samples are a type of laboratory quality control sample prepared from an independent, traceable standard at a concentration other than that used for analytical equipment calibration, but within the calibration range. Such reference samples are required for every analytical batch or every 20 samples, whichever is greater.

Release: Defined by section 101 of CERCLA as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant), but excludes (A) any release which results in exposure to persons solely within a workplace, with respect to a claim which such persons may assert against the employer of such persons, (B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine, (C) release of source, byproduct, or special nuclear material from a nuclear incident, as those terms are defined in the *Atomic Energy Act of 1954*, if such release is subject to requirements with respect to financial protection established by the U.S. Nuclear Regulatory Commission under section 170 of such Act, or, for the purposes of section 104 of CERCLA or any other response action, any release of source byproduct, or special nuclear material from any processing site designated under section 102(a)(1) or 302(a) of the *Uranium Mill Tailings Radiation Control Act of 1978*, and (D) the normal application of fertilizer.

Sample delivery groups (SDG): Assigned by the laboratory as the most frequent of the following:

- Each case of field samples received
- Each 20 field samples within a case
- Each 14 calendar day period during which field samples in a case are received.

Validation: Validation refers to a systematic process of reviewing a body of data against a set of criteria to provide assurance that the data are acceptable for their intended use. Validation methods may include review of verification activities, editing, screening, cross-checking, or technical review.

Verification: Verification refers to the process of determining whether procedures, processes, data, or documentation conform to specified requirements. Verification activities may include inspections, audits, surveillances, or technical review.

A1.0 PROJECT DESCRIPTION

A1.1 CONTEXT OF THE STUDY

Historically, detrimental effects have been associated with contamination (i.e., an excess of some hazardous substance, pollutant, or contaminant). The study will be most concerned with defining upper natural ranges of elements or compounds.

At this time, background soil data collected and analyzed using the current U.S. Environmental Protection Agency (EPA) protocols and methods have been generated on a project-by-project basis. These projects have focused primarily on the constituents of interest at potentially hazardous waste sites--not background. Background sampling was generally performed for local conditions and units. Common elemental concentration ranges and averages are available in literature sources for comparison, but analytical methods are not always stated or comparable. This project will provide information about a variety of locations on or considered similar to the Hanford Site.

Although substantially all environmental cleanup efforts at the Hanford Site are governed by the Tri-Party Agreement (Ecology et al. 1989), and the Site is considered a single facility for RCRA permitting purposes, no common site-wide standard or strategy exists for consolidated use of chemical background data. Individual project background data sets have been used thus far to define contamination. Consequently, "contamination" in one project could easily be consistent with background defined at another project or on another scale. Intuitively, there seems to be little value in defining areas as candidates for remediation solely because they are different.

Both contamination and cleanup standards must have a traceable and justifiable legal basis. The newly promulgated *Model Toxics Control Act* (MTCA) regulations provide some basis for cleanup standards, but do not define when contamination is significant. Under the MTCA regulations, natural background can be used to establish cleanup levels when natural background exceeds cleanup levels established by other methods.

A conceptual model for the chemical compositions of the Hanford Site soils has been developed. Collection and evaluation of new data will help corroborate, refute, or refine the model. This work will enable a more consistent use of contaminant and cleanup definitions predicated upon soil background concentrations.

The background conceptual model views soil background concentrations at the Hanford Site as a unified set of natural compositions ("single population" concept). Although two background areas may differ significantly in variability and/or average concentration, they may still be viewed as subsets of the overall Hanford Site background population. If this larger set can be described sufficiently by a single function, the two subsets are for practical purposes accepted as belonging to a common background population.

The *Characterization and Use of Soil and Groundwater Background for the Hanford Site* (WHC 1991) serves as a basis for this quality assurance (QA) plan and the associated sampling plan. Soil will be selected from a wide variety of pits, outcrops, and surface sites consistent with the aforementioned.

A1.2 STUDY OBJECTIVES

This project is to provide data to characterize soil background chemical composition on a site-wide scale and allow evaluation of a site-wide conceptual model. Data from this project will be used as a basis for comparison. Background soil concentrations will be measured and documented for selected inorganic elements using a set of defined sample collection procedures and EPA analytical methods. These elements are among those comprising compounds on the groundwater monitoring list (40 CFR Part 264 Appendix IX), the federal hazardous constituents list (40 CFR Part 261 Appendix VIII), and the dangerous waste constituents list of the Washington Administrative Code (WAC) 173-303-9905. (Table A-1 elements can be found on at least one of the three aforementioned regulatory lists.) Background soil concentrations of specified common soil elements, selected anions, and total organic carbon will be also be measured. Organic analytes that have been targeted include routine CLP volatile organics, semivolatiles, and pesticides/polychlorinated biphenyls (PCB). Nontarget compounds may also be reported in accordance with CLP protocols. Tables A-1, A-2, and A-3 list analytes and analytical methodology to be employed. Equivalent methods must be pre-approved by the Project Lead, and documented in project reporting.

Another objective of sampling is to gather data on grain size of those samples submitted for inorganic analysis. The variability of analytical results is a function of physical as well as chemical heterogeneity. The determination of the extent to which grain size (i.e., effective surface area) influences soil leachate compositions is the main objective of this part of the evaluation. Though fractions of the sample larger than 2-mm may be excluded from analysis, smaller fractions can still vary widely in relative particle size and hence, surface area per unit mass. This preliminary assessment will examine correlations between resulting chemical determinations and particle size.

Collection of extra sample material is also a sampling objective. Sufficient sample will be collected to allow future analyses (e.g., X-ray fluorescence, X-ray diffraction, petrographic examinations), at the discretion of the Plan Lead. Such measurements, as well as field observations, may be used with the above chemical data to generate a better understanding of background across the Hanford Site.

A2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

A2.1 SCOPE OF THIS PLAN

This Quality Assurance Project Plan (QAPP) applies specifically to the collection and analysis of background samples per the attached plan, and under the authorization of the RCRA Closure Activities Section's Background Task Teams. It is designed to be implemented in conjunction with the overall QA program requirements defined by the *Westinghouse Hanford Company Quality Assurance Manual* (WHC-CM-4-2) (WHC 1989). Quality assurance requirements shall also be implemented by the analytical laboratory Statement of Work (SOW) issued through the Westinghouse Hanford Company (Westinghouse Hanford) Office of Sample Management (OSM) and/or other governing procurement documents, as applicable.

A2.2 PROJECT MANAGEMENT RESPONSIBILITIES

Overall Westinghouse Hanford management and organizational structure may be found in WHC-CM-1-2, *Organizational Charts and Charters* (WHC 1987), and WHC-CM-1-3, *Management Requirements and Procedures* (WHC 1988). A project organizational chart is included as Figure A-1. Responsibilities of key personnel and organizations are described as follows:

- Plan Lead (RCRA Closure Activities Section). Westinghouse Hanford Environmental Division's RCRA Closure Activities Section manager is the Plan Lead responsible for overall project organization, performance, and any interface with the regulatory agencies and the U.S. Department of Energy.

- Project Lead. The Project Lead will be appointed by the manager of the RCRA Closure Activities Section. This person shall be responsible for overall direction of sampling and testing activities; responsibilities include the planning and authorization of all work and management of any subcontracted activities, as well as overall technical schedule.

- Geologist (Geosciences). Personnel assigned by the Geosciences Group manager will be responsible for choosing general sampling locations in conjunction with the Project Lead, determining specific judgement-selected sample locations, geologic logging, and geological interpretation. This interpretation may, at the discretion of the Project Lead, be supplemented with optional analyses. Geosciences will be responsible for arranging and verifying supplemental testing to support geological interpretations.

- Field Team Leader (Environmental Engineering). The Field Team Leader is assigned by the Environmental Engineering Technical Baseline manager. The Field Team Leader is responsible for onsite direction of the sampling team in compliance with the requirements of this QAPP, the respective sampling plan, and all implementing Environmental Investigation Instructions (EII).

- Quality Assurance Officer (Environmental Quality Assurance). The QA Officer is responsible for performing formal audits/surveillances to ensure compliance with requirements contained within the QA Project Plan. The QA Officer retains the necessary organizational independence and authority to identify conditions adverse to quality and to inform the Project Lead of needed corrective action. The QA Officer will review all proposals for additional analyses having an impact level 3 or higher.

- **Office of Sample Management.** The Westinghouse Hanford OSM is responsible for coordinating qualified and approved laboratory support for all analytes listed in Tables A-1, A-2, and A-3; assisting in the tracking of sample shipments; resolution of any chain-of-custody issues; and validating all related data.

A2.3 ANALYTICAL LABORATORIES

Soil samples shall be submitted to an approved Westinghouse Hanford, participant contractor, or subcontractor laboratory, which shall be responsible for performing the analyses identified in this plan in compliance with work order or contractual requirements and Westinghouse Hanford-approved procedures (see Section A4.2). All analytical laboratory work shall be subject to the surveillance controls invoked by QI 7.3, "Source Surveillance and Inspection" (WHC 1989). Each laboratory shall be responsible for the implementation of a written laboratory QA plan. This plan will meet appropriate requirements of the U.S. Department of Energy and the Tri-Party Agreement (Ecology et al. 1989). The Westinghouse Hanford OSM will retain the prime responsibility for ensuring the adequacy of offsite chemical laboratory QA activities.

A2.4 OTHER SUPPORT CONTRACTORS

Procurement of other support contractors may be assigned project responsibilities at the direction of the Project Lead. Such services shall be in compliance with standard Westinghouse Hanford procurement procedure requirements as discussed in Section A4.2. All work shall be performed in compliance with Westinghouse Hanford-approved QA plans and/or procedures, subject to controls of QI 7.3, "Source Surveillance and Inspection" (WHC 1989).

A3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENTS

The EPA has defined five analytical support levels for environmental investigations (EPA 1987a). Analytical support for this project shall correspond to levels IV and V for all EPA methods.

Chemical analyses and documentation needs will be accommodated by adherence to the latest applicable CLP SOW. Laboratory QA/quality control (QC) protocols shall be consistent with all EPA requirements therein. Requirements for laboratory instrument detection limits, precision, accuracy, and reporting are addressed by the protocol.

Some requested analytes and methods are not part of the CLP program. Analytical documentation should be comparable in detail to CLP Routine Analytical Services (RAS). Quality control deliverables shall include source and preparation date of calibration standards, initial and continuing calibration blanks, calibration verification data, matrix spike and duplicate data, sufficient information to confirm calculations, time and date of the analysis, analyst comments, and other pertinent information. Achieved analytical accuracy will be estimated by the laboratory from predigestion matrix spikes. Matrix spikes should be at appropriate concentrations and volumes to assess method accuracy at the mid-to-upper range of submitted samples. Laboratory duplicates shall be used by the laboratory to evaluate and report intralab-analytical precision. Laboratory accuracy and precision should be no less than recommended method and media specific guidelines contained in the applied procedure. Analyst comments are appropriate when guidelines are exceeded and/or unachievable. Detection limits shall be estimated and reported as either method detection limits per Chapter One of the Third Edition of SW-846 (EPA 1986a) or a comparable method based on standard deviation of multiple analyses of matrix blanks [e.g., limit of detection (LOD) defined by the American Chemical Society]. The definition used shall be clearly indicated in project documentation. Requested detection limits in Table A-2 are examples of approximate anticipated limits--not required parameters.

Goals for data comparability are addressed qualitatively by the adherence to written protocols for sample collection, shipment, and analysis. Sample data shall be reported on a dry-weight basis. Soil chemical data shall be reported consistently for each type of analysis as either mg/kg or μg/kg. Approved analytical procedures shall be consistent with the requested standard reference methods to facilitate the comparability of data sets. All significant deviations must be pre-approved in compliance with Section A4.1. The Westinghouse Hanford OSM will be responsible for notifying the Project Lead of all deviations.

Goals for data representativeness are addressed qualitatively by professional judgement regarding adequacy of geological coverage and by randomization of specific sample collection locations over delineated target units. The Project Lead or designee will justify sampling sites as being accurately representative of Hanford Site soils.

A4.0 SAMPLING PROCEDURES

A4.1 WESTINGHOUSE HANFORD COMPANY SAMPLING AND INVESTIGATIVE PROCEDURES

All sampling activities are to be consistent with the applicable current procedures of WHC-CM-7-7 (WHC 1988) and the Site-Wide Background Soil Sampling Plan. Matters adversely affecting quality shall be reported to management. The QA Officer shall assist in resolving any conflicts arising between this plan, the sampling plan, and company procedures.

Field work shall be reasonably distant from any known or suspected hazardous waste site or localized pollutant source. All sampling equipment shall be clean before use in accordance with the sampling plan. Decontamination may be performed by EII 5.5, "1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment" (WHC 1988). Soil sampling activities shall be performed in compliance with the applicable sampling plan and EII 5.2, "Soil and Sediment Sampling" (WHC 1988). The eligible material and basis of selection for each sampled location shall be documented. Soil samples shall routinely be routed to offsite analytical laboratories for chemical analyses. The procedure EII 5.11, "Sample Packaging and Shipping," will guide this effort. Other applicable investigation procedures to be used by sampling personnel include the following:

- "Field Logbooks" . . . . EII 1.5
- "Chain of Custody" . . . . EII 5.1
- "Hanford Geotechnical Sample Library Control" . . . . EII 5.7A
- "Geologic Logging" . . . . EII 9.1

A4.2 PARTICIPANT CONTRACTOR/SUBCONTRACTOR PROCEDURES

As noted in Section A2.3, participant contractor and/or subcontractor services may be procured at the direction of the Project Lead. All such procurement shall be subject to the applicable requirements of QR 4.0, "Procurement Document Control;" QI 4.1, "Procurement Document Control;" QI 4.2, "External Services Control;" QR 7.0, "Control of Purchased Items and Services;" QI 7.1, "Procurement Planning and Control;" and/or QI 7.2, "Supplier Evaluation" (WHC 1989). Whenever such services require procedural controls, requirements for use of Westinghouse Hanford procedures, or for submittal of contractor procedures for Westinghouse Hanford review and approval before use, shall be included in the procurement document or work order, as applicable. In addition to the submittal of analytical procedures, analytical laboratories shall be required to submit the current version of their internal QA/QC program plans. All analytical laboratory QA/QC plans and procedures shall be reviewed and approved before use by qualified Westinghouse Hanford personnel. All participant contractor or subcontractor procedures, plans, and/or manuals shall be retained as project quality records in compliance with EII 1.6, "Records Management" (WHC 1988); QR 17.0, "Quality Assurance Records;" and QI 17.1, "Quality Assurance Records Control" (WHC 1989).

A4.3 PROCEDURE ADDITIONS AND CHANGES

Should deviations from established EIIs be required to accommodate unforeseen field situations, they may be authorized by the Field Team Leader in accordance with the requirements of EII 1.4, "Deviation from Environmental Investigation Instructions" (WHC 1988). Documentation, review, and disposition of instruction change authorization forms are defined within EII 1.4. Other types of document change requests shall be completed as required by the Westinghouse Hanford procedures governing their preparation and revision.

A5.0 SAMPLE CUSTODY

All samples obtained during the implementation of the sampling and analysis plan shall be controlled as required by EII 5.1, "Chain of Custody" (WHC 1989), from the point of origin to the analytical laboratory. Laboratory chain-of-custody procedures shall be reviewed and approved as required by Westinghouse Hanford procurement control procedures as noted in Section A4.2, and shall ensure the maintenance of sample integrity and identification throughout the analytical process. Offsite sample tracking will be performed by the Westinghouse Hanford OSM procedure "Sample Tracking" (WHC 1990).

Results of analyses shall be traceable to original samples through a unique code or identifier. Westinghouse Hanford will assign the samples Hanford Environmental Information System (HEIS) sample numbers. All results of analyses shall be controlled as permanent project quality records as required by QR 17.0, "Quality Assurance Records" (WHC 1989), and EII 1.6, "Records Management" (WHC 1988).

A6.0 CALIBRATION PROCEDURES

Calibration of all critical Westinghouse Hanford measuring and test equipment, whether in existing inventory or newly purchased, shall be controlled as required by QR 12.0, "Control of Measuring and Test Equipment;" QI 12.1, "Acquisition and Calibration of Portable Measuring and Test Equipment" (WHC 1989); QI 12.2, "Measuring and Test Equipment Calibration by User" (WHC 1989); and/or EII 3.1, "User Calibration of Health and Safety Measuring and Test Equipment" (WHC 1988). Routine operational checks for Westinghouse Hanford field equipment shall be as defined within applicable EIIs or procedures; similar information shall be provided in Westinghouse Hanford-approved participant contractor or subcontractor procedures.

Calibration of Westinghouse Hanford, participant contractor, or subcontractor laboratory analytical equipment shall be as defined by applicable standard analytical methods, subject to Westinghouse Hanford review and approval.

A7.0 ANALYTICAL PROCEDURES

Analytical chemical methods are identified in Tables A-1, A-2, and A-3. Physical analysis of particle size shall be performed by ASTM D 422 - 63. Other analyses may be performed on reserved portions of the samples in accordance with Section A1.2. Procedures based on the referenced methods shall be selected or developed, and approved before use in compliance with appropriate Westinghouse Hanford procedure and/or procurement control requirements as noted in Section A4.2.

A8.0 DATA REDUCTION, VALIDATION, AND REPORTING

A8.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

All analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and for preparing a detailed data package that includes all information necessary to perform data validation to the extent indicated by the minimum requirements of Section A8.2. Data shall be reported on a dry-weight basis. Data summary report format and data package content shall be defined in procurement documentation subject to Westinghouse Hanford review and approval as noted in Section A4.2. At a minimum, laboratory data packages shall include the following:

- Sample receipt and tracking documentation, including identification of the organization and individuals performing the analysis, the names and signatures of the responsible analysts, sample holding time requirements, references to applicable chain of custody procedures, and the dates of sample receipt, extraction, and analysis

- Instrument calibration documentation, including equipment type and model, initial and continuing calibration data, and method detection limits including reference to the procedure used for their determination

- Additional quality control data, as appropriate for the methods used, including matrix spikes, duplicates, recovery percentages, precision data, laboratory blank data, and identification of any nonconformances that may have affected the laboratory's measurement system during the time period in which the analysis was performed

- The analytical results or data deliverables, including reduced data, reduction formulas or algorithms, unique laboratory identifiers, and description of deficiencies.

Other supporting information, such as reconstructed ion chromatographs, spectrograms, traffic reports, and raw data, will be included in the submittal of individual data packages as necessary to meet the requirements of Section A8.2. All sample data shall be retained by the analytical laboratory and made available for systems or program audit purposes upon request by Westinghouse Hanford, DOE-RL, or regulatory agency representatives (see Section A10.0). Such data shall be retained by the analytical laboratory through the duration of their contractual statement of work, at which point it shall be turned over to Westinghouse Hanford for archiving.

The completed data package shall be reviewed and approved by the analytical laboratory's QA Manager before submittal to Westinghouse Hanford OSM for validation as discussed in Section A8.2. The requirements of this section shall be included in procurement documentation or work orders, as appropriate, in compliance with the standard Westinghouse Hanford procurement control procedures referenced in Section A4.2.

A8.2 VALIDATION

Validation of the completed data package shall be performed by qualified Westinghouse Hanford OSM personnel. Validation requirements will be defined within approved Westinghouse Hanford OSM data validation procedures (WHC 1990) or if lacking, within the referenced guideline document. At a minimum validation will include the requirements as defined within this section.

For CLP inorganic RAS analyses, validation reports shall be prepared documenting checks of the following areas, as recommended in *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA 1988a):

- Sample holding times
- Initial and continuing calibration
- Method blank samples
- Interference check samples
- Laboratory control samples
- Duplicate sample analysis
- Matrix spike samples
- Atomic absorption quality control requirements
- Inductively coupled plasma serial dilutions
- Sample result verification
- Overall data assessments.

For volatile and semivolatile analyses, validation reports shall be prepared documenting checks of the following areas, as recommended in *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses* (EPA 1988b):

- Holding times
- Gas chromatography/mass spectroscopy tuning and instrument performance
- Initial and continuing calibration
- Blanks
- Surrogate recoveries
- Matrix spike/matrix spike duplicate performance
- Internal standards performance
- Compound identification
- Compound quantitation and reported detection limits
- Tentatively identified compounds
- System performance
- Overall data assessments.

For pesticides/PCB analyses, validation reports shall be prepared documenting checks of the following areas in accordance with the previous guidance (EPA 1988b):

- Holding times
- Pesticides instrument performance
- Initial, analytical sequence and continuing calibration
- Blanks
- Surrogate recoveries
- Matrix spike/matrix spike duplicate performance.

- Compound identification
- Compound quantitation and reported detection limits
- Overall data assessments.

For other analyses performed by offsite laboratories, validation reports shall be also be prepared. The results of these analyses will be substantiated with checks similar to the above two lists as applicable per the analytical procedure, EPA guidance, and OSM policy.

A8.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

All validation reports and supporting analytical data packages shall be subjected to a final technical review by qualified reviewers at the direction of the Westinghouse Hanford Project Lead, before submittal to regulatory agencies or inclusion in reports or technical memoranda. All validation reports, data packages, and review comments shall be retained as permanent project quality records in compliance with EII 1.6, "Records Management" (WHC 1988), and QA 17.0, "Quality Assurance Records" (WHC 1989). The Project Lead will bear the primary responsibility for dispositioning project related records and data.

A9.0 INTERNAL QUALITY CONTROL

All analytical samples shall be subject to in-process quality control measures in both the field and laboratory. The quality of data generated in this project will be operationally defined by the following internal quality control sampling.

- Split or collocated samples shall be collected and submitted to separate laboratories for a measurement precision assessment.

- Sample splits will be submitted to the Hanford Geotechnical Library for later reference at the option of the Plan Lead. Storage need not exceed 24 months.

- Blind reference samples may be introduced into any sampling round at the Project Lead's direction as a performance and audit of the primary laboratory.

- Sand trip and equipment/field blanks are to be submitted with samples designated for volatile organic analysis (VOA). The latter will also be submitted in conjunction with semivolatile and pesticide/PCB analyses.

- Trip (VOA) blanks shall be prepared before going in the field. These blanks should not be opened in the field, but should accompany samples from the field to the analytical laboratory. Trip blanks may help to assess a source if samples are found to contain unexpected compounds. Trip blanks shall be submitted at a frequency of one per shipping chest of VOA samples.

- Laboratory internal quality control checks performed per applicable protocol for the analysis. For chemical analysis, this must include data demonstrating achieved accuracy, precision, method calibration, and performance. Reportables will include:
  - Preparation and calibration blanks
  - Calibration verification standards
  - Matrix spikes
  - Duplicates
  - Control samples
  - Other supporting documentation.

The minimum requirements of this section shall be invoked in procurement documents or work orders, compliant with standard Westinghouse Hanford procedures as noted in Section A4.2.

A10.0 PERFORMANCE AND SYSTEM AUDITS

No performance, system, or program audits are currently scheduled, but all program activities are subject to oversight by Westinghouse Hanford QA personnel. Audits may address quality-affecting activities that include, but are not limited to, measurement system accuracy; intramural and extramural analytical laboratory services; field activities; and data collection, processing, validation, reporting, and management. Any Westinghouse Hanford QA audits will be performed under the Standard Operating Procedure requirements of WHC-CM-4-2 (WHC 1989).

System audit requirements are implemented in accordance with Standard Operating Procedure QI 10.4, "Surveillance" (WHC 1989). All quality-affecting activities are subject to surveillance. The Project Lead will interface with both the Environmental Field Services Quality Coordinator and the QA Officer. The former is responsible for performing surveillance oversight of Environmental Engineering, Geotechnology, and Permitting function activities. The QA Officer is responsible for providing independent formal audits/ surveillances to ensure compliance with planned activities, and identify conditions adverse to or enhancing overall performance quality.

A11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratory that directly affects the quality of the analytical data shall be subject to preventive maintenance measures that ensure minimization of measurement system downtime. Field equipment maintenance instructions shall be as defined by the approved procedures governing their use. Laboratories shall be responsible for performing or managing the maintenance of their analytical equipment; maintenance requirements, spare parts lists, and instructions shall be included in individual methods or in laboratory QA plans, subject to Westinghouse Hanford review and approval. When samples are analyzed using EPA reference methods, the requirements for preventive maintenance of laboratory analytical equipment as defined by the reference method shall apply.

A12.0 DATA ASSESSMENT PROCEDURES FOR PRECISION, ACCURACY, AND COMPLETENESS

A12.1 DATA ASSESSMENTS BY ANALYTICAL FACILITY

Precision, accuracy, and completeness procedures for reporting laboratory measurements are specified by CLP protocol. Adherence to this protocol and approved procedures will be sufficient for the majority of measurements. Several analytical measurements will not be made by standard CLP methods. To the extent possible, performance-based standards will be the preferred method of assessment for precision and accuracy measurements. A familiar example is the use of control charts. Values exceeding a 3-sigma limit on well-established and appropriate control chart should be flagged when reported. Samples in the analytical batch should be rerun if possible, and those results also reported.

When appropriate performance-based standards are not available and referenced procedures do not specify, the following two rules may be used.

1. Precision--The difference between laboratory duplicates will be subject to a control limit of 150% of the requested limit whenever both sample values exceed the estimated method detection limit (MDL). If the estimated MDL exceeds the requested limit, the higher value may be used to calculate the control limit. When either or both duplicates are below the estimated method detection limit, laboratory precision may be assessed by comparing identically spiked samples. Samples exceeding five times the control limit can be subject to a 20% relative percent difference limit, where:

   $$\text{Relative Percent Difference} = \frac{(S - D) \times 100}{((S+D)/2)}$$

   S = Higher of two duplicate sample values
   D = Lower of two duplicate sample values

   Failure to meet a precision limit will require evaluation and corrective action as appropriate.

2. Accuracy--Accuracy will be defined by percent recovery data where

   $$\%\ \text{Recovery} = \frac{(\text{Spiked Sample Result} - \text{Sample Result})}{\text{Spike Added}} \times 100$$

   When the sample result (SR) is less than the MDL, use SR=0 for the purpose of calculating the percent recovery. Spiked samples having concentrations two to five times greater of the requested detection limit or MDL will have recovery control limits of 50% to 150%. Spiked samples exceeding five times the estimated MDL will have recovery control limits of 75% to 125%. Failure to meet the control limit will require evaluation and corrective action as appropriate. Applicable samples not meeting the limit should be rerun using a postdigestion spike if possible. Postdigestion spikes should be made at two times the indigenous level or lower reporting limit, whichever is greater.

A12.2 PROJECT LEVEL ASSESSMENTS

All data requested through OSM will be subject to Westinghouse Hanford OSM validation procedures as previously described (Section A8.2). Completeness of requested analyses will be assessed and reported to the Project Lead by Westinghouse Hanford OSM. The EPA guidance suggests 80% to 85% is a reasonable expectation (EPA 1987b).

Summary statistics for measurement precision and accuracy shall be prepared in conjunction with the data analysis.

Precision evaluation at the project level will address interlaboratory precision. Precision of environmental measurement systems is often a function of concentration. This relationship should be considered before selecting the most appropriate form of summary statistic. Simplistically, this relationship can usually be classified as falling into one of the following three categories.

1. Standard deviation (or range) is constant.

2. Coefficient of variation (or relative range) is constant.

3. Both standard deviation (or range) <u>and</u> coefficient of variation (or relative range) vary with concentration.

The pooled standard deviation or pooled coefficient of variation can be used to summarize data in cases 1 and 2, respectively. Case 3 will require either graphical summary of the data or specialized regression techniques.

Data quality assessments are generally made at concentrations typical of the observed range in routine analyses. In some situations the typical value measurement will be below an estimated practical method, or instrument detection limit (i.e., an engineering zero). If a standard exists (or is to be set) at some positive finite value, quality assessment summaries may be desired at that level rather than the most representative concentration.

A13.0 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance reports, nonconformance reports, or audit activity shall be documented and dispositioned as required by QR 16.0, "Corrective Action;" QI 16.1, "Trending/Trend Analysis;" and QI 16.2, Corrective Action Reporting" (WHC 1989). Primary responsibilities for corrective action resolution are assigned to the Project Lead and the QA Officer. Other measurement systems, procedures, or plan corrections that may be required as a result of routine review processes shall be resolved as required by governing procedures or shall be referred to the Project Lead for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project QA records upon completion or closure.

A14.0 QUALITY ASSURANCE REPORTS

Special QA reports are not planned for this project. Project records will be maintained in conformance with standard operating procedure requirements of WHC-CM-7-7 (WHC 1988). Project records will maintained according to EII 1.6, "Records Management," and technical data will be dispositioned according to EII 1.11, "Technical Data Management." Surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records upon completion or closure of the activity. The final report shall include an assessment of the overall adequacy of the total measurement system with regard to the data quality objectives of the investigation.

A15.0 REFERENCES

Ecology et al. 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland, Washington.

EPA, 1979, *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, U.S. Environmental Protection Agency/Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

EPA, 1983, *Interim Guidelines and Specifications for Preparation of Quality Assurance Project Plans*, QAMS-005/80, U.S. Environmental Protection Agency/Office of Exploratory Research, Washington, D.C.

EPA, 1986a, *Test Methods for Evaluating Solid Wastes*, SW-846, Third Edition, U.S. Environmental Protection Agency/Office of Solid Waste and Emergency Response, Washington, Washington, D.C.

EPA, 1986b, *National Primary Drinking Water Regulations*, Title 40, Code of Federal Regulations, Part 264, App. IX as amended, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987a, *Data Quality Objectives for Remedial Response Activities: Development Process*, EPA/540/6-87/003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987b, *Data Quality Objectives for Remedial Response Activities: Development Process*, EPA/540/6-87/003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, Hazardous Site Evaluation Division, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988c, *USEPA Contract Laboratory Program Statement of Work for Organic Analysis*, Sample Management Office, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989a, *USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis*, Sample Management Office, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989b, *Hazardous Waste Management System; Testing and Monitoring Activities (Proposed Rule)*, in Federal Register, Vol. 54, No. 13, pp. 3212-3228.

WHC, 1988, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Westinghouse Hanford Company Quality Assurance Manual*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, *Westinghouse Hanford Company Sample Management and Administration Manual*, WHC-CM-5-3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, WHC-MR-0246, Westinghouse Hanford Company, Richland, Washington.

Figure A-1. Project Organization.

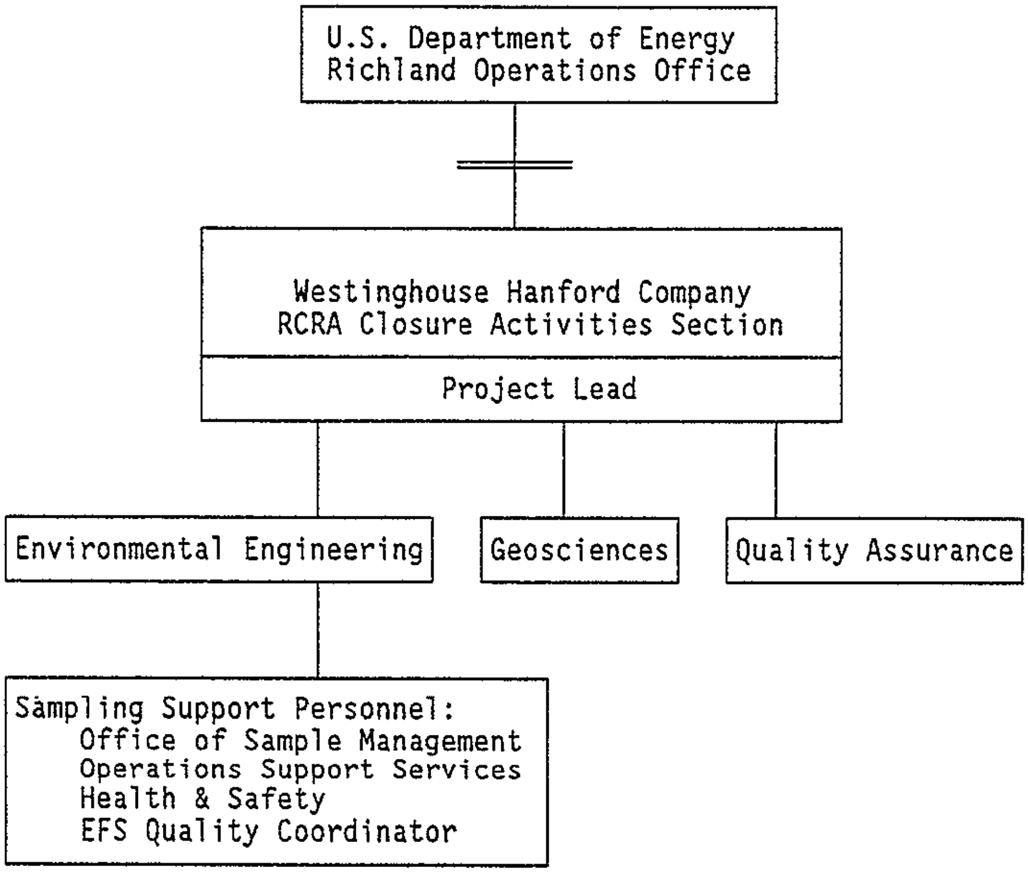

Table A-1. Primary Inorganic Analytes.

Element	Typical expected (mg/kg)	Requested soil detection (mg/kg)	Requested method
Antimony	0 - 3	12	204.2 CLP-M
Arsenic	0 - 8	2	206.2 CLP-M
Barium	44 - 229	40	200.7 CLP-M
Beryllium	0 - 0.8	1	200.7 CLP-M
Cadmium	0 - 8	1	213.2 CLP-M
Chromium	2 - 48	2	200.7 CLP-M
Cobalt	0 - 15	10	200.7 CLP-M
Copper	0 - 20	5	200.7 CLP-M
Lead	1 - 13	0.6	239.2 CLP-M
Mercury	< 0.2	0.1	245.5 CLP-M
Nickel	6 - 25	8	200.7 CLP-M
Selenium	0 - 0.1	1	270.2 CLP-M
Silver	0 - 1.5	2	272.2 CLP-M
Thallium	0 - 0.2	2	279.2 CLP-M
Vanadium	24 - 96	10	200.7 CLP-M
Zinc	27 - 112	4	200.7 CLP-M

Table A-2. Secondary Inorganic Analytes.

Element	Typical expected (mg/kg)	Requested soil detection (mg/kg)	Requested method
Aluminum	3600 - 13300	40	200.7 CLP-M
Calcium	2000 - 14000	1000	200.7 CLP-M
Iron	19000 - 29000	20	200.7 CLP-M
Magnesium	2780 - 6910	1000	200.7 CLP-M
Manganese	164 - 2870	3	200.7 CLP-M
Molybdenum	< 4	0.5	7481
Potassium	455 - 2600	1000	200.7 CLP-M
Sodium	125 - 1710	1000	200.7 CLP-M
Silicon	200 - 2900	20	200.7 CLP-M
Titanium	500 - 3500	50	Any method capable of meeting the requested DL
Zirconium	15 - 65	5	Any method capable of meeting the requested DL
Chloride	0 - 20	1	300.0
Nitrate and nitrite	0 - 15	1	300.0
Phosphate	0 - 3	2	300.0
Sulfate	0 - 35	2	300.0
Fluoride	0 - 8	1	Extraction by 300.0, Analysis by ASTM D 3868 - 79
Ammonium	0 - 4	1	Any method capable of meeting the requested DL
Carbonate	Highly Variable	1.0%	ASTM D 4373 - 84

Table A-3. Contract Laboratory Program Organic Analyses and Total Organic Carbon.

Contract Laboratory Program target compounds	Typical expected (ug/kg)	Requested quantitation limits	Requested method
Volatiles (currently 33 compounds)	0	Low Soil	Most recent CLP-SOW[1]
Semivolatiles (currently 64 compounds)	0	Low Soil	Most recent CLP-SOW[2]
Pesticides/PCBs (currently 28 compounds)	0	Low Soil	Most recent CLP-SOW[3]
Total organic carbon	Variable (usually< 1%)	0.1% detection limit (DL)	Any method capable of meeting the requested DL

[1]A CLP modification of EPA Method 624 (Purgeables).
[2]A CLP modification of EPA Method 625 (Bases/Neutrals and Acids).
[3]A CLP modification of EPA Method 608.

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APPENDIX B

SOIL BACKGROUND SITE MAPS

LIST OF FIGURES

APPENDIX B

SOIL BACKGROUND SITE MAPS

This appendix contains a map showing the 12 proposed general sites within the Hanford Site boundaries. Each site is also shown on a more detailed topographic map. Additionally, the two sites located outside the Hanford Site boundaries are shown on detailed maps.

Figure B-1. Hanford Site Map Showing Locations of Soil Background Sampling Sites.

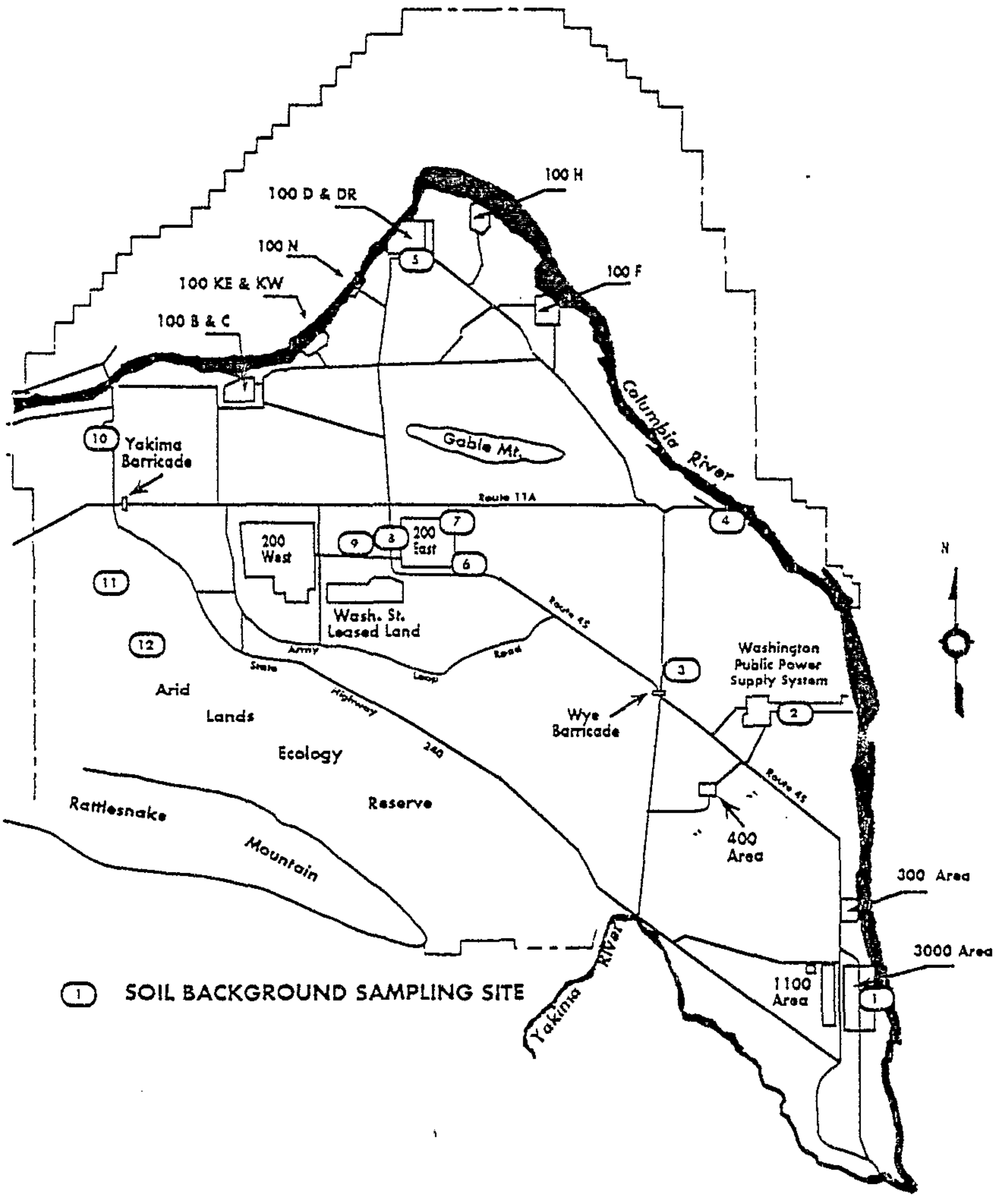
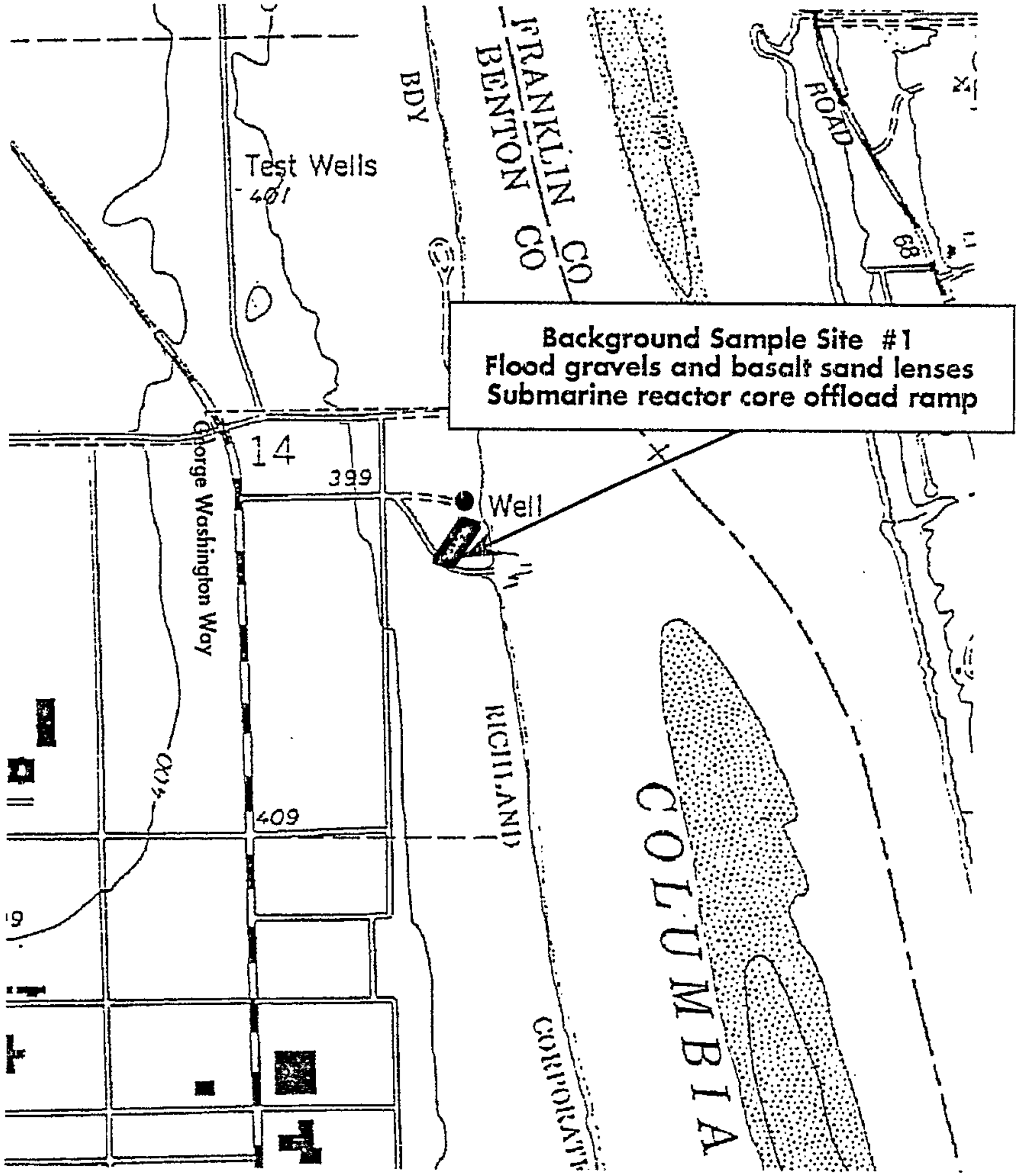
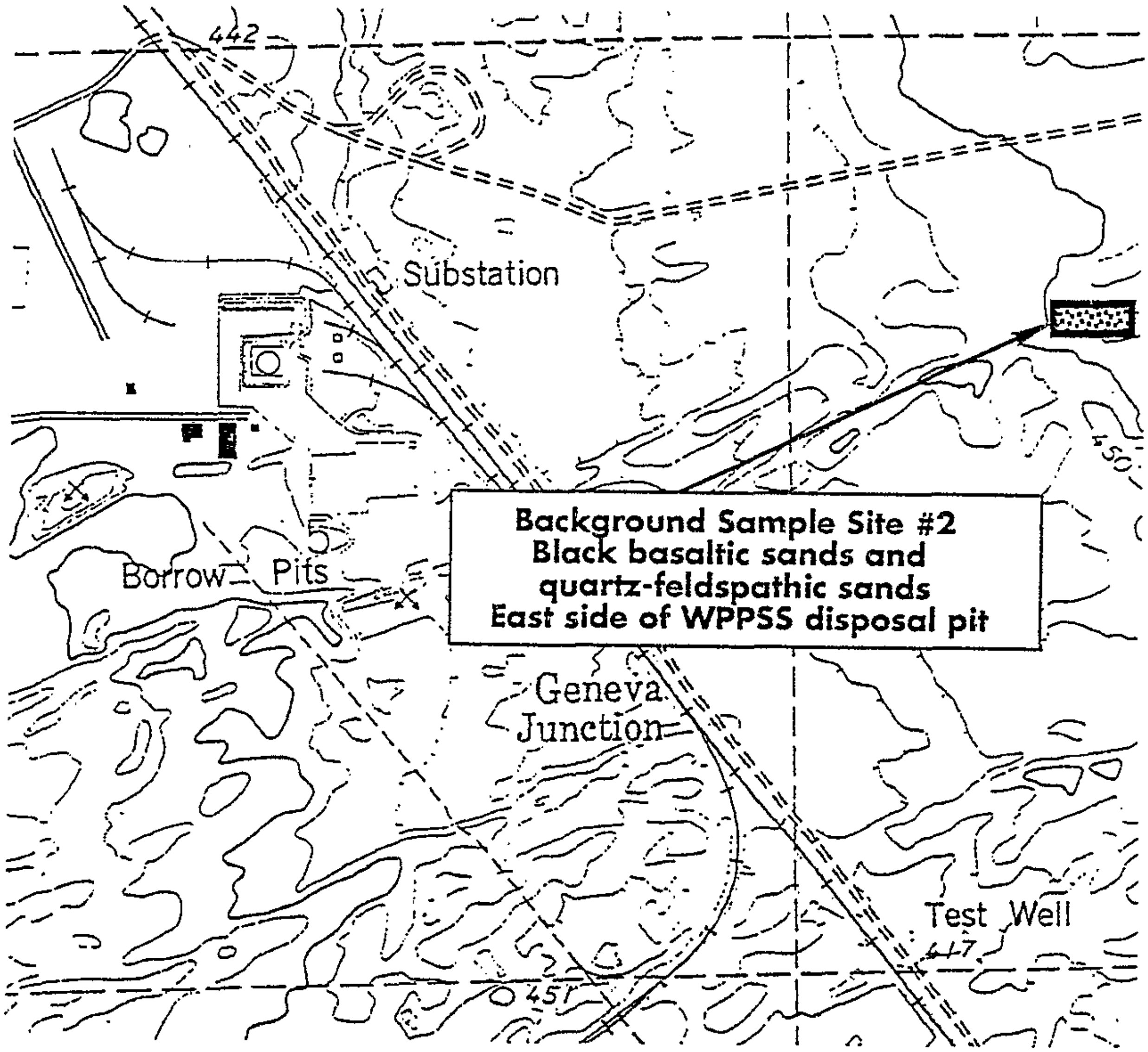


Figure B-2. Background Sample Site #1.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-3. Background Sample Site #2.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-4. Background Sample Site #3.

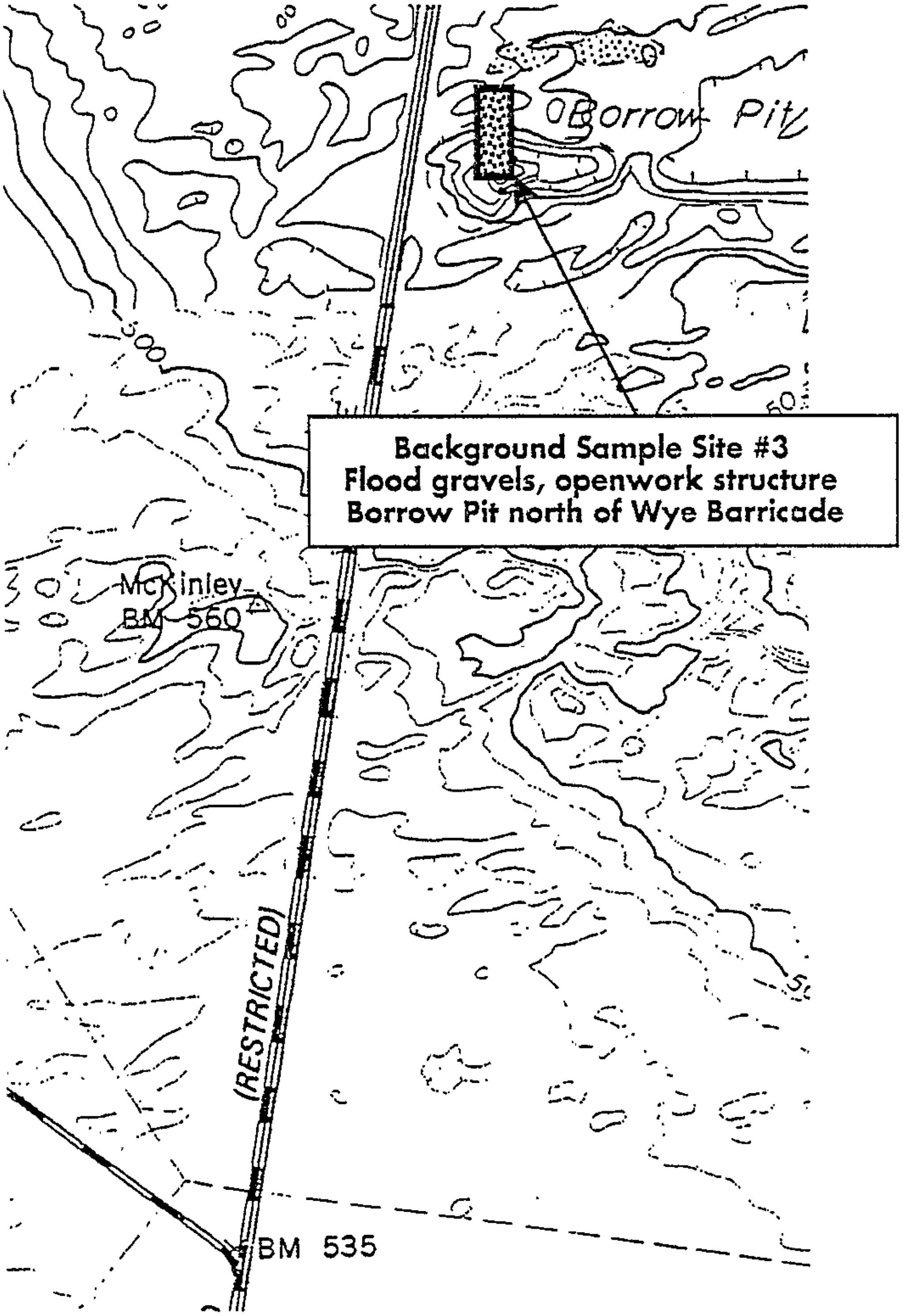


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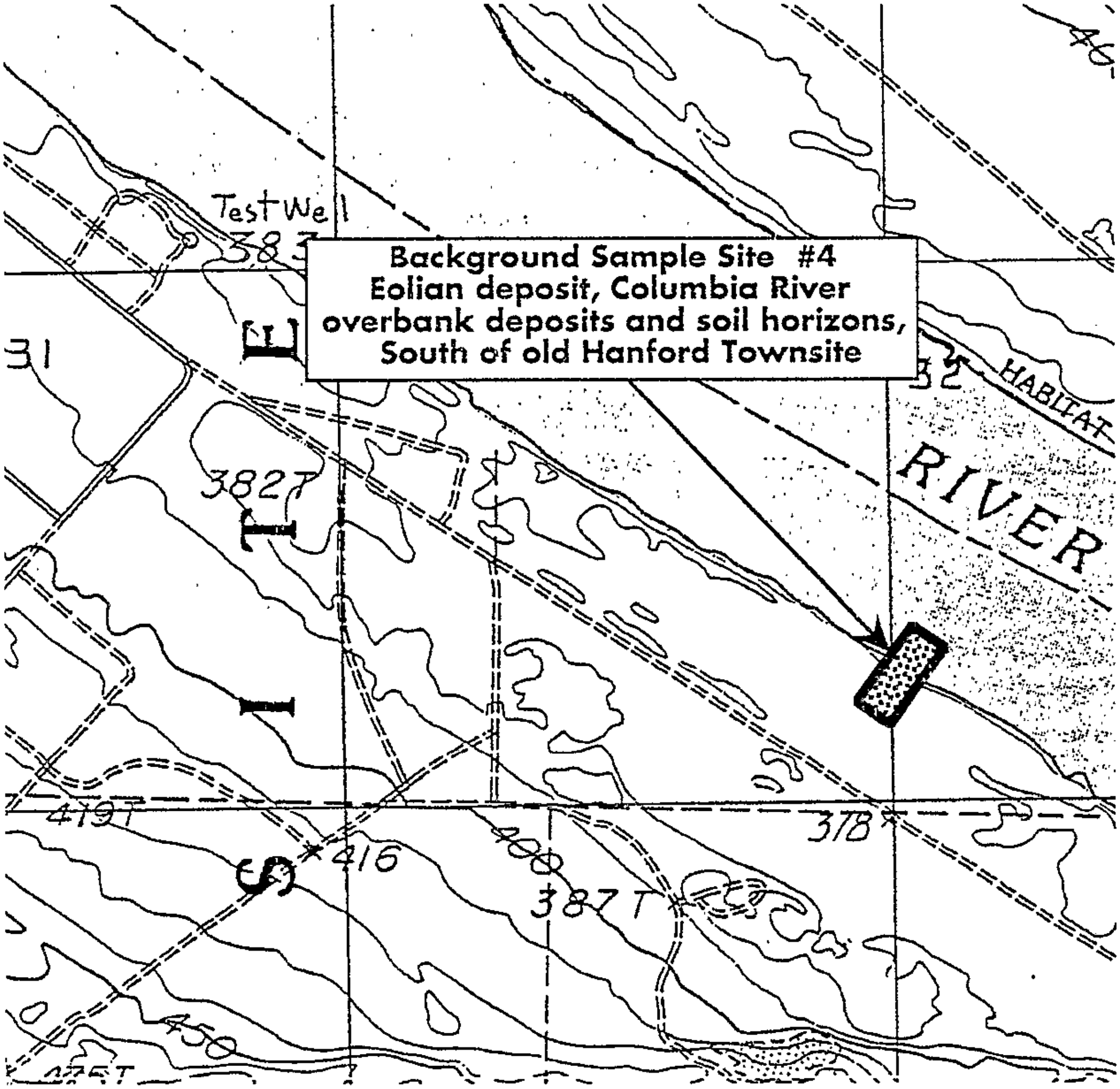
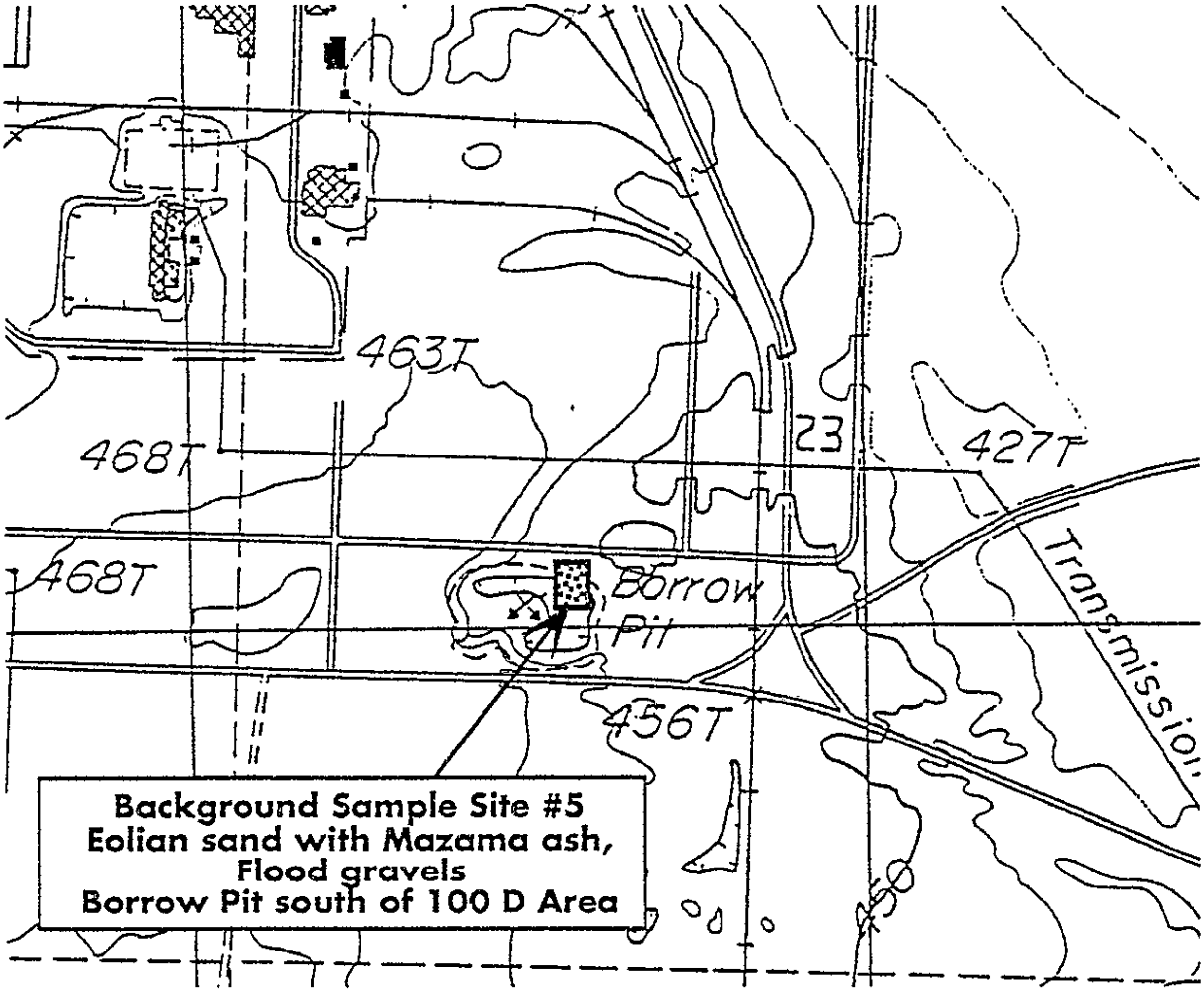
Figure B-5. Background Sample Site #4.



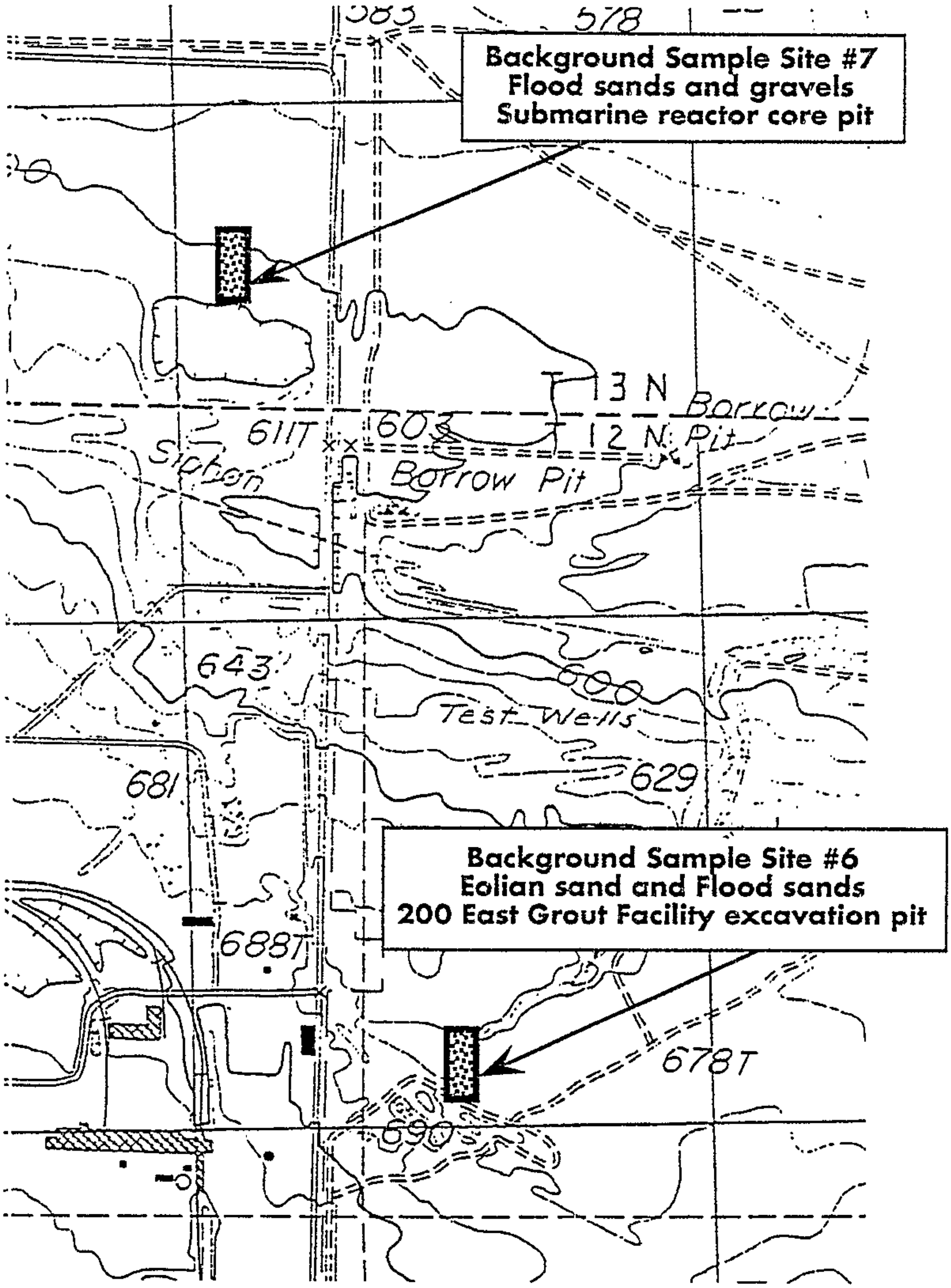
(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-6. Background Sample Site #5.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

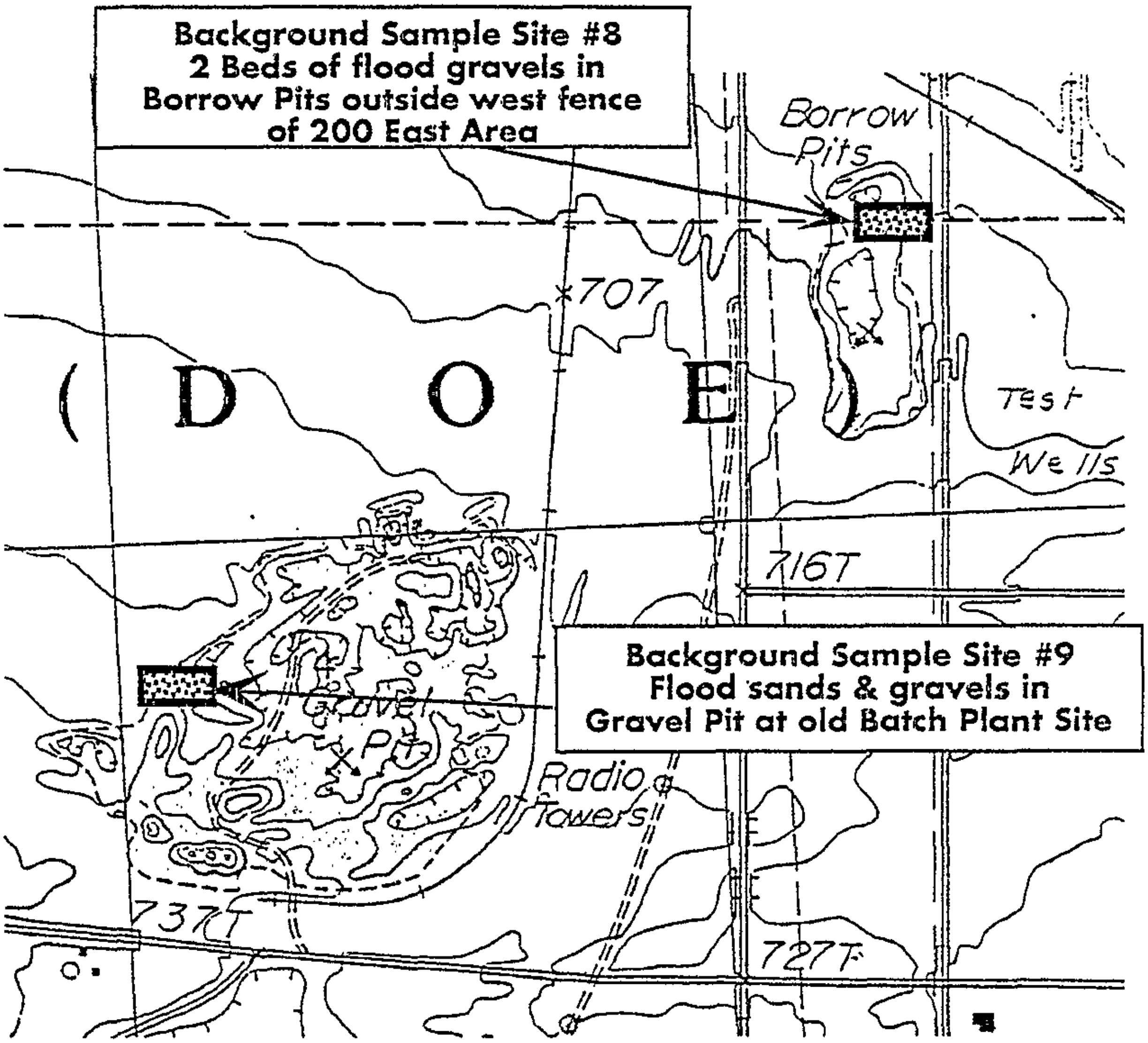
Figure B-7. Background Sample Sites #6 and #7.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

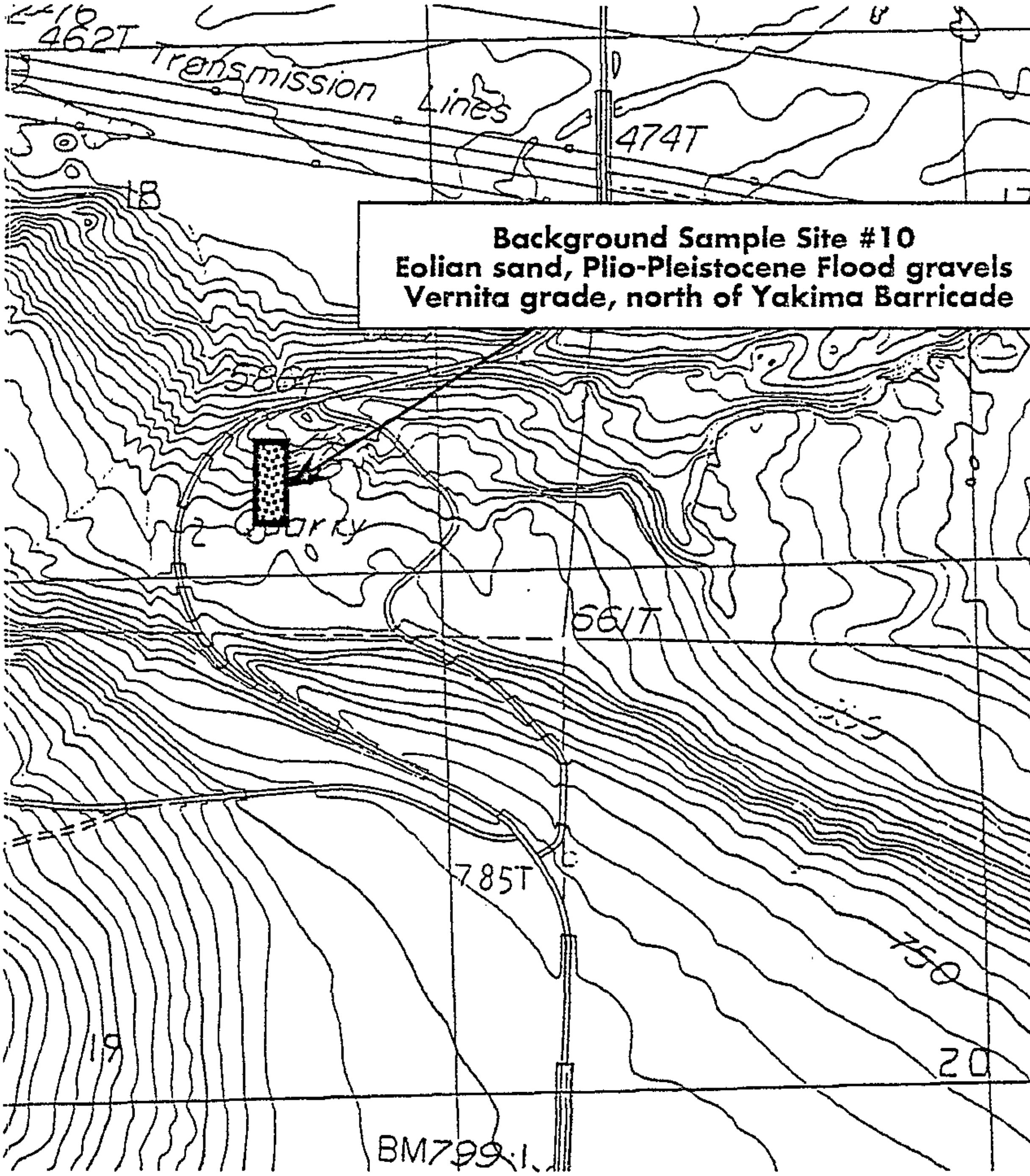
9 1 1 2 2 . 1 1 6 7

Figure B-8. Background Sample Sites #8 and #9.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-9. Background Sample Site #10.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-10. Background Sample Site #11.

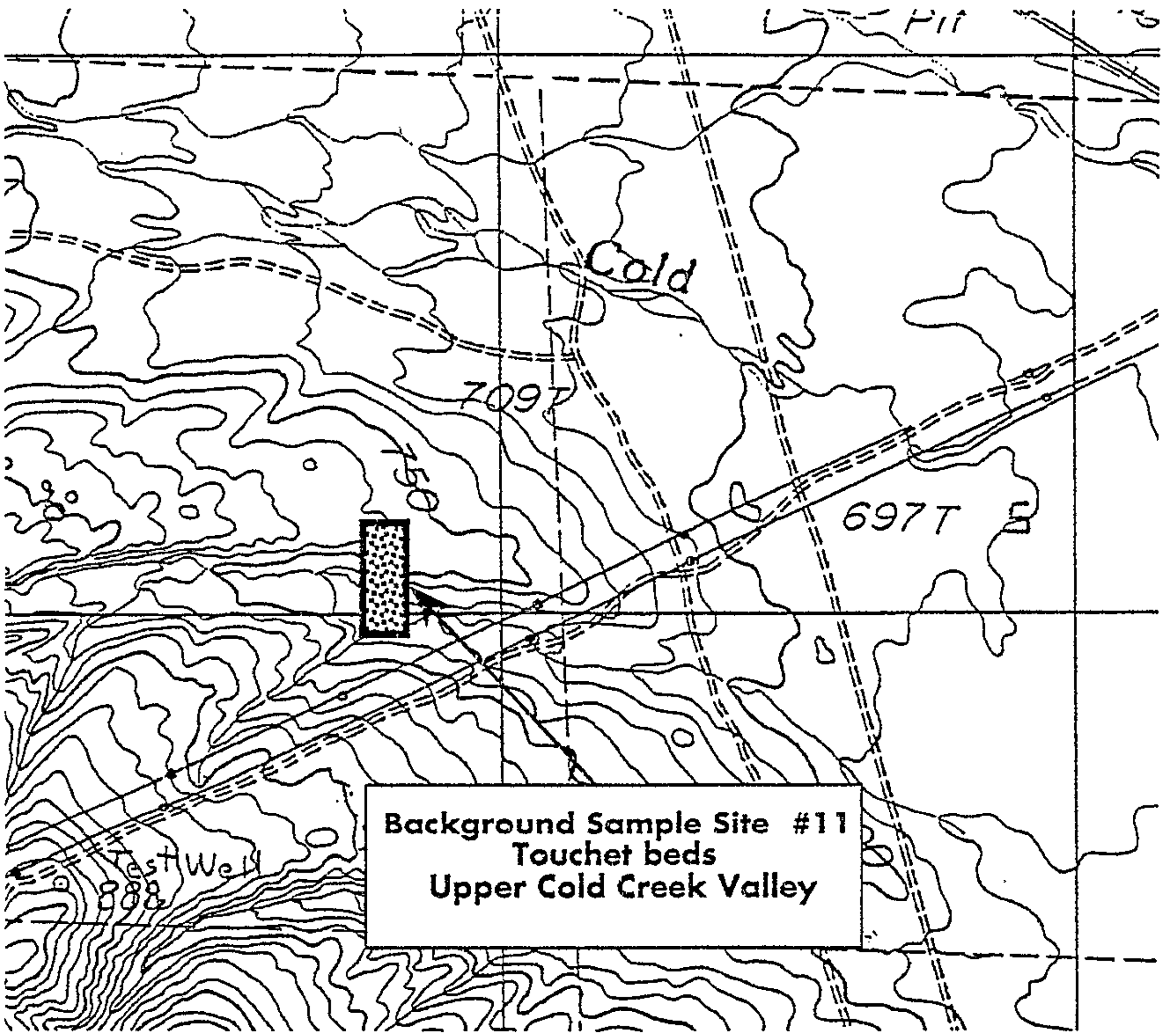


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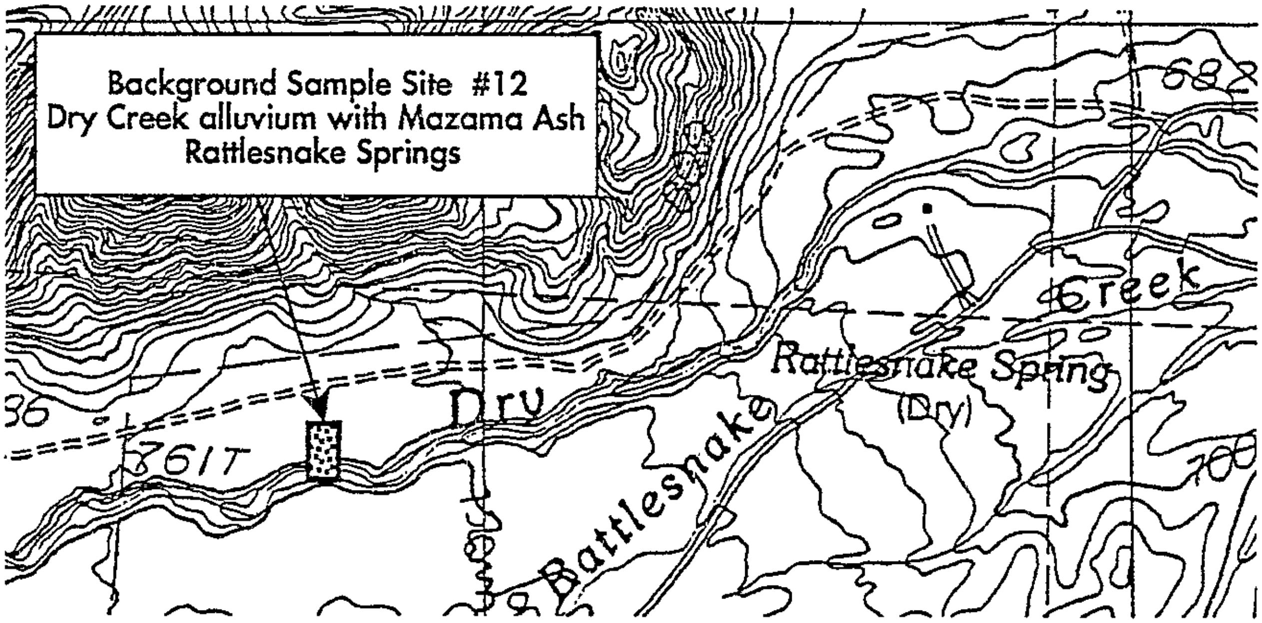
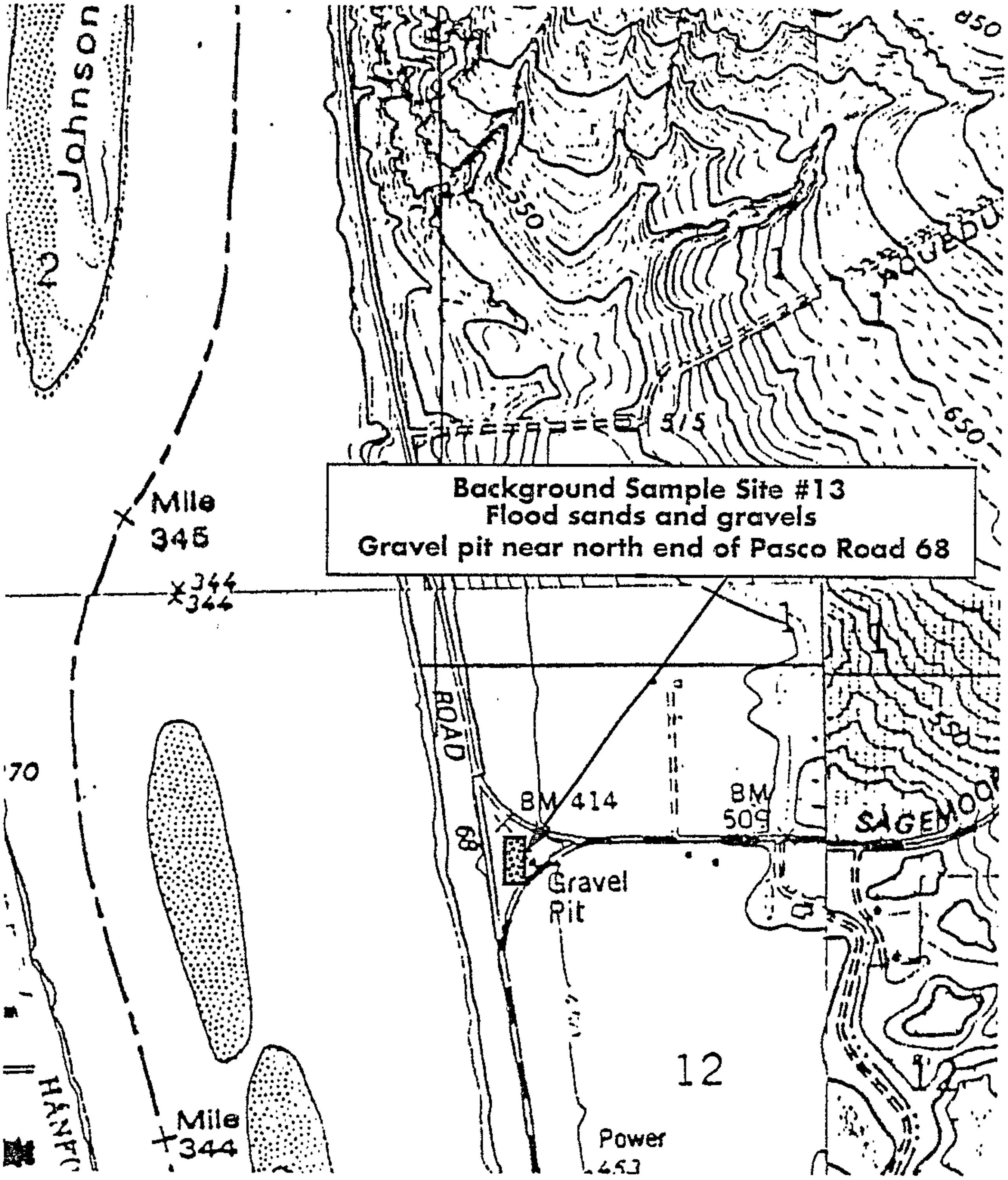
Figure B-11. Background Sample Site #12.



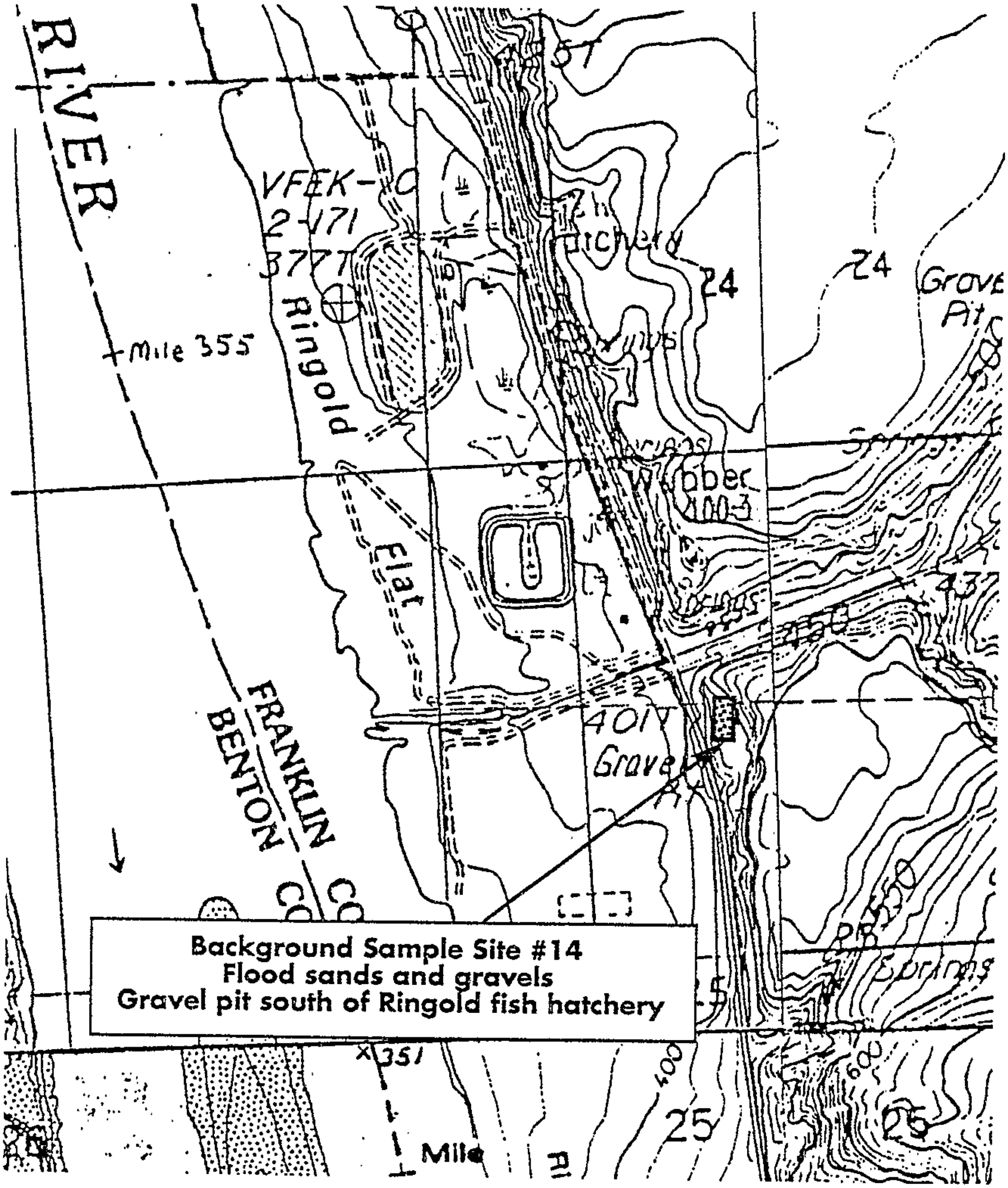
(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)

Figure B-12. Background Sample Site #13.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000

Figure B-13. Background Sample Site #14.



(From 1982 USGS Topographic Map, Approximate Scale 1:12,000)